National Park Service
U.S. Department of the Interior

Northeast Region
Inventory & Monitoring Program
Northeast Temperate Network
Woodstock, Vermont

Acadia National Park Amphibian and Reptile Inventory: March – September 2001

Technical Report NPS/NER/NRTR—2005/007

ON THE COVER
Northern Green Frog: *Rana clamitans melanota*
Spotted Salamander *Ambystoma maculatum*
Photographs by: Bill Gawley

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Summary

Under a National Park Service/Wildlife Conservation Society Cooperative Agreement, an inventory of amphibians and reptiles at Acadia National Park in Maine was conducted from March through September 2001. Seven standardized sampling methods were employed; anuran call counts, egg-mass counts, time-constrained search, coverboards, turtle trapping, minnow trapping, and drift fence arrays. In addition, animals encountered outside of standardized surveys (temporally or spatially) were recorded as incidental encounters. The method that documented the most species was incidental encounters, which recorded all 18 species found during this inventory. Nine species were recorded during wetland time-constrained search, eight with minnow trapping, seven during woodland/old field time-constrained search, six by anuran call counts, five species each using coverboard and stream surveys, four species using drift fencing and pitfall traps, three during egg-mass counts, and two species in the course of turtle trapping. All 18 species were documented in wetland habitats, followed by 17 on roads, 14 in uplands, nine in streams, and seven in tidal habitats. Of the 281 localities (120 standardized sampling sites plus 161 incidental encounter locations) at which amphibians or reptiles were recorded, 44% (123) were wetlands, 34% (96) were roads, 15% (41) were uplands, 6% (18) were streams, and <1% (three) were tidal habitats.

The 18 amphibian and reptile species documented represent 82% (18/22) of the species believed to historically have occurred at Acadia. Six frog/toad, five salamander, two turtle, and five snake species were encountered during this survey. The spring peeper, spotted salamander, painted turtle, and common garter snake were the most widely distributed and encountered species in each taxonomic group. The most abundant species in each taxonomic group, based on total numbers of adults encountered were spring peeper, spotted salamander, painted turtle, and common garter snake. The American toad was recorded at seven new sites on the west side of Mount Desert Island. However, in spite of several historic records, none were found on the east side of the island. The four-toed salamander, listed as a *Species of Special Concern* by the Maine Department of Inland Fisheries and Wildlife and previously recorded at only one location, was found at nine locations on both sides of Mount Desert Island. These sites were identified primarily by searching in sphagnum moss dominated wetlands. The four-toed salamander was the only state-listed species found. The northern ring-necked snake was documented for the first time on Isle au Haut.

Many species were observed crossing roads throughout the park during rainy weather or breeding/nesting seasons. In particular, spotted and four-toed salamanders, painted and snapping turtles were found crossing Route 233 near Eagle Lake and on Duck Brook Road in significant numbers. Road casualties may be a significant mortality factor for amphibians that breed in wetlands in close proximity to well-traveled roads and turtle and snake populations at these sites may be similarly impacted. Regular monitoring and temporary closure of these roads, during peak breeding and nesting seasons (especially on rainy nights) are recommended to prevent episodes of high road mortality of these species. Road sections where major amphibian and reptile mortality occur should be evaluated for elevating above

grade or installation of wildlife friendly road tunnels and leaders to provide safe travel routes for migrating animals in heavy traffic areas.

Of the four species not found during this survey, grey treefrog and musk turtle were historically present but rarely encountered. They may still be present. More focused sampling is needed to determine their status. The absence of two formerly common amphibian species, northern leopard frog, and northern dusky salamander is more troubling. Their disappearance is not likely due to road mortality, and their apparent extirpation from the park may be due to any of a number of factors linked to recently documented amphibian declines. These include air pollutants in their many forms, pesticides, the impact of introduced fishes, and diseases such as iridovirus and chytrid fungus. Additional work focused on these two species including intensive surveys of historical sites and analysis of habitat condition and changes, including pollutant loads at those sites is recommended to determine the possible causes for the extirpation of these two species.

Each survey method was useful in sampling different habitats and specific species, and it is recommended that any future inventories targeting the entire herpetofauna include each method, and sample a wide range of habitats. Conversely, an inventory targeted at a particular species will need to sample specific habitats using only one or two methods. While a detailed plan for monitoring is beyond the scope of this inventory, the results suggest that, in terms of both feasibility and priority, a monitoring program based on anuran call counts, time or spatially constrained stream/brook surveys, coverboards, and aquatic turtle trapping would be the most useful methods for generating quantitative data useful for trends analysis.

Acknowledgments

Funding for this project was provided by the National Park Service, and numerous people assisted with the project. We thank Natalie Marioni and Jennifer Purrenhage for their countless hours in the field at all hours of the day and night, and Bruce Connery and David Manski for providing help in so many ways. Many others contributed to the project, and we especially thank Becky Chalmers, Mary Beth Koloszvary, Jesse Cunningham, Karen Anderson, Paul Wilson, Melissa Boyd, John Cousins, Anders Rhodin, the National Park Service rangers, and full-time and seasonal staff.

Introduction

Acadia National Park is the only National Park in the northeastern United States. Established in 1916, it was the first national park created east of the Mississippi River, and more significantly, the land was donated entirely by private citizens. It is located along the mid-coast of Maine (44º 12' – 44º 27' N., 68º 19' – 68º 27' W.) and adjacent to Bar Harbor. It is a land of contrast and diversity. Acadia is positioned within the broad transition zone between eastern deciduous and northern coniferous or boreal forests. Surrounded by ocean, its steep slopes rise above the rocky shore, including Cadillac Mountain, which at 466 m (1530') is the highest point on the Atlantic coast north of Brazil. The park includes areas on Mount Desert Island, the Schoodic Peninsula, and Isle au Haut and its land area approximates 19,425ha (48,000 acres). In 1901, then Harvard University president Charles W. Eliot formed a public land trust to protect Mount Desert Island from uncontrolled development. Philanthropist and industrialist John D. Rockefeller, Jr., donated more than 10,000 acres of land and was responsible for the miles of scenic gravel carriage roads that wind through Acadia's forested interior.

The geologic processes forming the landscapes of Acadia date back 550 million years. The resilient land continued to rise relative to the sea until about 10,000 years ago, when it stabilized. Glacial erosive activity has left a series of north-south trending granite ridges separated by deep U-shaped valleys. One of the valleys, Somes Sound, is the only fjord on the east coast of North America (Lubinski et al. 2003). The uplands have thin, granitic soils with many areas of bedrock or talus with minimal soil development. Wetlands are underlain by marine deposits or poorly drained tills and include both mineral soil and organic soil wetlands (Calhoun et al. 1994; Lubinski et al. 2003).

The climate of the region is often cool and humid with periods of fog throughout the year. At Bar Harbor, rainfall averages 123 cm (49") annually, with about 1.5 m (5') of snowfall. Temperature ranges from -9º C (-16º F) in winter to 41º C (105º F) in summer, with a mean annual temperature (1940-1980) of 8º C (46º F) (Patterson et al. 1983; Lubinski et al. 2003).

Acadia is interwoven with a wide variety of freshwater, estuarine, intertidal, and forest resources. Much of the park is covered by spruce-fir forest, but it also contains stands of oak, maple, American beech, and other hardwoods more typical of much of New England. Approximately 20% of Acadia National Park is classified as wetland. These features include marine aquatic beds, intertidal shellfish flats, marshes of varying salinity, isolated freshwater marshes and swamps, and boglands. They serve to maintain biodiversity through their provision of diverse habitats. Some 1,100 vascular plant species, including many adapted to acidic, low nutrient bogs and rocky treeless mountain summits, are found in the park. Some 300 birds and 40 mammal species have been recorded. Acadia's amphibians and reptiles are inextricably linked to the park's wetland and adjacent areas. While these features have received good attention during eclectic studies, little information has been published on the herpetological resources associated with them.

In 1998, a Cooperative Agreement between the National Park Service and the Wildlife Conservation Society was formed to assess amphibian and reptile assemblages within the parks of the "New England Cluster" of the National Park Service. As part of this inventory project, Acadia National Park was surveyed from March through September 2001. While the goals of the project vary between parks, they generally are as follows:

- Inventory and record at least 90% of the species currently estimated to occur in the park.
- Determine the occurrence and status of species of management concern (e.g., state and federal *Threatened*, *Endangered*, and *Special Concern Species*, and other declining species).
- Determine abundance categories, distribution, and habitat use of documented species.
- Identify critical habitats of *Threatened*, *Endangered*, and *Special Concern* species.
- Provide basis for future development of a long term monitoring program.
- Analyze species occurrence against historical occurrence and evaluate the state of the park's herpetofauna, on a site and regional scale.

An "estimate" of species expected to be present in Acadia was generated using National Park Service species lists, park files, literature search, discussion with park staff and others familiar with local herpetofauna, and Maine's "Herp Atlas" information. Numerous authors have described aspects of the amphibians and reptiles of found on Mount Desert Island/Acadia National Park over the course of the 20th century, each providing a slightly different picture of the occurrence and abundance of species (Bishop and Clarke 1923; Stupka 1933; Manville 1938, 1939 and 1964; Davis 1958 and 1960; Favour 1963; Burnley and Raha 1971; White 1974; Zabinski and Olday 1977; Coman 1987; McCrystal 1988; Green et al. 1992; Rhodin 1992; Mittelhauser 1995; Mittelhauser et al. 1996; Russell and Connery 1997; Glanz and Connery 1999). Manville (1938) noted the existence of many specimens in a park collection, but by the late1950's some of these specimens could not be found (Davis 1958). At the time of this inventory (2001), voucher specimens of Acadia amphibians and reptiles were no longer extant. Without preserved material, or photographic evidence, the historic information evaluated was largely anecdotal in nature and some of it seemed to have been passed from author-to-author without validation. Thus, questionable or conflicting accounts were appraised based on the level of detail provided, accuracy/plausibility in describing species identification, habitats, and behavior, and number of independent observations.

Collectively, this literature provides a fairly complete picture of species occurrence, reporting a total of 26 species (Appendix 1). These include a leatherback turtle (*Dermochelys coriacea*) caught in lobster trap ropes off of Isle au Haut in 1934 (Manville 1938) and now well documented off the Maine coast (Shoop and Kenney 1992), a wood turtle (*Glyptemys insculpta*) and Blanding's turtle (*Emydoidea blandingi*) dismissed as released pets (Coman 1987), and black racer (*Coluber constrictor*). Racers were observed in 1973 and 1974 by a

competent observer (McCrystal 1998). Racers are conspicuous where present and since they had not been observed historically nor subsequently, these individuals suggest a failed colonization. Thus, of the 26 species reported, based on the strength of the literature and recent reports by park staff, 22 were considered as likely to have occurred historically and/or presently in the wild in the non-marine habitats of Acadia National Park (Appendix 1).

A combination of seven standardized survey methods were used in the inventory. In addition, incidental encounters were recorded to provide additional information on species presence and distribution in the park. The habitat type of all sites where amphibians and reptiles were found was described, and the species and the habitat types they occupied were analyzed.

Study Area

Acadia National Park is located in Hancock and Knox counties and situated approximately 72 km (45 miles) east of Bangor, Maine. National Park Service lands are found on Mount Desert Island (12,140 ha / 30,000 ac); Isle au Haut (1,214 ha / 3,000 ac), an island accessible by ferry from Stonington; Schoodic Peninsula (809 ha / 2,000 ac); and additional lands held in conservation easements (Fig 1) (Patterson et al. 1983). Acadia lies at the southern edge of Westveld's spruce-fir-northern hardwoods region (Westveld 1956) and these constitute the most extensive vegetation type in the park (Lubinski et al. 2003). The majority of wetlands in Acadia National Park and vicinity are classified as marine (38%) and dominated by algal beds of the rocky shoreline, and palustrine (32%) in nature and include forested wetlands, bogs, and fens (Calhoun et al. 1994). The lacustrine system's many lakes and ponds, and their associated littoral habitats comprise 20% and 11% respectively, of the wetlands, while only 0.2% of the region's wetland habitat has been classified as riverine (Calhoun et al. 1994). Periodic fires have spread through areas of Mount Desert Island, the most famous and recent being the fire of 1947 that burned much of the east side of Mount Desert Island (Patterson et al. 1983; Lubinski et al. 2003). A new forest of open canopy birch, maple, and aspen has grown up amid the surviving evergreens.

Herpetological habitats in Acadia National Park include low salinity and freshwater wetlands of many descriptions, vernal pools, ponds, lakes, spring seepages, intermittent brooks, streams, and associated upland old fields, meadows, woodlands, and their ecotones. Descriptions of specific localities sampled are found in this report's tables, appendices, and species accounts.

Figure 1. Species distribution maps for amphibians and reptiles found in Acadia National Park during herpetological inventory surveys in 2001.

Methods

Both general and targeted standard survey methods were used in stream, wetland, upland, road, and tidal habitats. Multiple methods were often used in a given habitat because these habitats often support diverse amphibian and reptile species and require several methods to sample the entire herpetological community. A total of 21 different habitat types were described and grouped into five more general habitat categories; streams, wetlands, uplands, roads, and tidal (Appendix 2) to provide a general description of each survey site. While roads are not a "natural" habitat type for animals, the term was used to describe the location of species when they were observed crossing gravel carriage roads, paved roads, and trails.

Site selection for standardized surveys was designed to sample across the range of available habitat types within each of the five habitat categories. Within a habitat category, site selection considered the following factors; (1) sites with historical accounts of species presence, (2) sites of seemingly high habitat quality for which no data existed and (3) sites subjectively determined based on prior experience elsewhere as most likely to produce records of species that were considered rare, uncommon, or of unknown status. While there was a degree of randomness in that sites were selected to provide broad geographic coverage of the park, since the primary goal of the inventory was to document species' occurrence, the above considerations were given more weight than strict randomness in the site selection process. In addition, since there were several other research projects involving park herpetofauna ongoing in 2001 (Bank 2003, Chalmers 2004, Cunningham 2003, Kolozvary 2003), sites were selected to complement rather than duplicate those already being sampled.

Incidental encounter locations represent specific points where animals were encountered outside of formal surveys. Since many incidental encounters occurred at standardized survey sites, it was difficult to analyze standardized survey site data and incidental encounter data separately. Therefore, the measure of a species' overall distribution was obtained by combining the number of standardized survey sites and incidental encounter locations at which it was recorded. This summed term is referred to as "localities". There were 281 localities. Of these, 55 were standardized survey sites, 65 were both standardized survey sites and incidental encounter locations, and 161 were incidental encounter localities only.

Quantifying overall abundance was problematic due to the fact that each of the methods used provides a sample biased towards a particular species or group of species. However, since sampling effort was fairly evenly divided among the different methods and sampling biases were thus more or less compensated for, an overall measure of abundance for each species was derived by summing the number of adult form individuals (as opposed to eggs or larvae) encountered during each of the seven survey methods. For time-constrained search, coverboard checks, turtle and minnow trapping, drift fence surveys and incidental encounters, the numbers of adults of a given species encountered during each sampling occasion were summed. Since amphibians were not marked for individual identification, for the purposes of quantifying overall abundance, reptiles were also treated as though they had not been marked. Since anuran call counts and egg mass counts do not directly count adults, the numbers of adults represented by these samples was estimated as follows. For egg mass

counts, each wood frog egg mass represents the presence of one adult female (Crouch and Paton 2000). For spotted salamanders, Cook (1978) determined that, on average, each egg mass represented 0.633 females. Thus, the number of females present at a site was estimated as 0.633 times the number of egg masses. While males were obviously also present, they are not readily estimated and are not included. For anuran call counts, index values were converted to conservative estimates of the number of calling males present, based on data collected at Cape Cod National Seashore where both index values and estimates of numbers calling were made (Cook, unpublished data). Conservatively estimated numbers are as follows: Spring Peeper Index 1=3 males, Index 2=7 males, Index 3=20 males; American Toad Index 1=2 males, Index 2= 6 males; Wood Frog Index 1=1 male; Pickerel Frog Index 1=2 males, Index 2=7 males; Green Frog Index 1=2 males, Index 2= 8 males, Index 3 = 12 males; Bull Frog Index 1=2 males, Index 2 = 5 males.

While these estimates are the best available of overall abundance, they are best interpreted not so much as absolute numbers but rather, as a reasonably accurate representation of ranked relative abundance and differences between species in the order of magnitude of their abundance.

Common and scientific names and spellings are those of Crother (2000) (Appendix 3). A Garmin III Plus Global Positioning System (GPS) unit was used to record the distance or area searched during time-constrained surveys (Appendix 4) and the coordinates of coverboard arrays (Appendix 5) and drift fence arrays (Appendix 6). Coordinates of each site surveyed during standardized surveys (Appendix 7) and location identified during incidental encounters (Appendix 8) were also recorded. GPS locality data were recorded as Universal Transverse Mercator (UTM) grid coordinates X=x-axis or Easting, and Y=y-axis or Northing, using NAD83.

Color photographs representing each species captured in the park were taken and appear at the end of this report (Appendix 13). Given the low-impact nature of this study, voucher specimens of live animals were not collected. However, road-kill or dead specimens fit for preservation were collected and preserved in 70% alcohol. Each of these specimens was labeled with collector's name and date and location site, and stored in the park museum at Acadia. These voucher specimens will be entered into the park museum database for future reference.

Anuran Call Counts

Anuran call counts were conducted using the Wisconsin frog and toad survey method (Heyer et al. 1994) at 59 pond and wetland sites. Because Mount Desert Island is largely divided into east and west sides by Somes Sound, to better describe and analyze species distributions, sites were grouped as occurring on the east or west side of Mount Desert Island, and Isle au Haut. There were 37 anuran call count sites surveyed on the east side of Mount Desert Island, 21 on its west side, and one site on Isle au Haut.

Anuran call counts record the presence of species at specific sites and provide an index of abundance based on the calling intensity of species heard. Call index values and criteria for

assigning them are; 0 = no calls, 1 = individuals can be counted, 2 = overlapping of calls, 3 = full chorus-calls are constant and individually indistinguishable. The surveyors arrived at each sample site at least one half-hour after dusk. Researchers listened for anuran calls for five minutes, recording species heard, the number of individuals observed, if any, and the call index for each species. In addition to conducting call counts in the field, a cassette tape recorder (Heyer et al. 1994) was set at 17 sites. The recorder, set up at dusk, was placed approximately one meter from the edge of the water and every half-hour recorded for a 90-second time interval. Species presence and call intensity were interpreted from the recordings by researchers in the lab.
Of the 59 anuran call count locations, 35 were surveyed once, 14 twice, and 10 were surveyed between three and five times in the spring from 16 April – 20 June 2001. Sites surveyed more frequently than others were selected for ACC from the beginning of the season, were more easily accessible, and were in areas where the frog recorder could be readily set-up at dusk. Because of the unequal number of surveys at each site, and the predominance of sampling in early spring, there is some bias against detecting species with low detection probabilities, as well as those that call later in the season. Multiple call counts at a site, conducted over the entire spring and early summer months are necessary to document species presence over time, as different anuran species are active at different times of the season (Conant and Collins 1998; Crouch and Paton 2002).

Egg-Mass Counts

Amphibians such as spotted salamanders (*Ambystoma maculatum*) and wood frogs (*Rana sylvatica*) migrate to ponds in the early spring to breed, depositing gelatinous egg masses. These masses are attached to fallen tree branches and vegetation in the water (Petranka 1998; Hunter et al. 1999). Egg-mass counts were conducted to record species presence and to document evidence of breeding by these and other pond-breeding amphibians (Albers and Prouty 1987; Mitchell 2000). Fifteen ponds on Mount Desert Island were surveyed one to two times, and three ponds on Isle au Haut were surveyed once. Since extensive egg-mass counts were already being conducted by University of Maine at Orono (UMO) researchers Mary Beth Kolosvary and Jesse Cunningham at a majority of the park's wetlands (Cunningham 2003, Kolozvary 2003), sites selected in this inventory were wetlands sites for which little or no data on amphibian occurrence existed. Thus these data should be considered as adding to that body of work.

All egg-mass counts were conducted during the day, between 20 April - 16 May 2001. In counting egg masses, the entire pond was traversed when possible, visually searching for egg masses, identifying and counting all egg masses observed. As evidence of the presence of spotted salamanders in the absence of egg masses, spermatophores were also searched for. While every effort was made to count all masses present in a pond, because spawning is only loosely synchronized, counts based on a single survey may underestimate total numbers of egg masses laid. At the ponds where two counts were made (3 of 18), abundance was based on the larger of the two. Since the majority of ponds where egg mass counts were conducted were counted once, numbers of egg masses and species presence is likely underestimated.

Time-Constrained Search (TCS)

Habitat specific time-constrained search (TCS) was conducted in all habitats likely to support amphibians and reptiles, i.e. streams, woodlands, fields, and wetlands/ponds. Searches were conducted by moving through the habitat at a given site and searching under the best available cover (i.e. rocks, logs) favored by amphibians and reptiles (Bury and Raphael 1983), and by dip netting ponds (Heyer et al. 1994). An Index of Abundance (IA) for each species was calculated by dividing the total number of individuals recorded by the total search effort (person hours) spent for each search. Person hours are the total amount of time spent searching, multiplied by the number of people participating in the search.

Streams

Ten streams sites, eight on Mount Desert Island and two on Isle au Haut, were searched once between 11 May and 13 August 2001. Total search time ranged from 0.6 to 3.0 search hours/stream (Appendix 4). The streams were divided into three zones: (1) stream, (2) splash zone, and (3) bank. The stream zone included the area with flowing water; the splash zone encompassed the area from the edge of the water to the bank, and the bank zone extended three meters from the edge of the splash zone onto the bank. Starting and ending times (Eastern Standard Time) and the number of people searching were recorded. Investigators systematically moved upstream, using a dip net in the stream to capture amphibians as rocks were overturned. Rocks, logs, and debris in the splash zone and on the bank were overturned and searched under. Identification and life stage (adult or larva), as well as collection zone and substrate data, were recorded for each animal captured. The adult life stage was defined as any individual not in the larval stage and the larval stage, was defined as an individual with gills, showing pre-metamorphic characteristics. Substrate types were divided into eight categories: (1) boulder (25-50+ cm), (2) cobble (10-25 cm), (3) gravel (1-10 cm), (4) sand (<1 cm), (5) leaf, (6) log, (7) dirt, and (8) other.

Woodlands/Fields

Nine sites, seven woodland and two field on Mount Desert Island were searched one to three times (most just once) between 17 May and 29 August 2001. Total search time ranged from 0.6 to 2.2 search hours/site (Appendix 4). Dimensions of area searched, start and end times, number of searchers, and the identification, number, and sex of individuals found were recorded.

Wetlands/Ponds

Twenty wetlands and pond sites on Mount Desert Island were searched one to two times from 2 May to 4 September 2001. Total search time ranged from 0.3 to 4.6 search hours/site (Appendix 4). Searches were conducted by traversing the entire pond when possible, sampling with a dip-net for amphibian larvae and adults, as well as turtles, and snakes. Start and end times, number of searchers, and the identification, number, and sex of individuals found were recorded.

Coverboards

Coverboards (Grant et al. 1992) were used primarily to inventory snakes. Boards were 0.6m x 1.2m (2' x 4') and made of corrugated sheet metal or plywood. In April and early May 2001, coverboards were deployed on top of snow and existing vegetation at 10 field sites and one wetland meadow on Mount Desert Island, and one field site on Bar Island. Even numbers of boards ranging from two to 12 (depending on size of habitat patch) were placed five meters apart in linear "arrays" consisting of alternating wood and metal boards. Arrays were five meters from and parallel to the woodland edge. These coverboards were checked twice monthly from 8 May - 17 September 2001.

On 14 June 2001, 11 corrugated sheet metal coverboards were distributed among seven sites on Isle au Haut. Because of the amount of time and effort involved in deploying these boards, only one or two metal boards, and no wood boards, were deployed at each site. These were checked monthly in July, August, and September.

Capture rates (CR) were calculated as the number of snakes captured under boards divided by the total number of board checks for each site. Each time a board was checked constituted a "board check". Therefore, a site with 12 boards visited six times equaled 72 board checks. The number of snakes captured per 100 coverboard checks were calculated as:

$$CR = \frac{(\#\text{ of individual snakes captured})}{(\text{total }\#\text{ of board checks})} \times 100$$

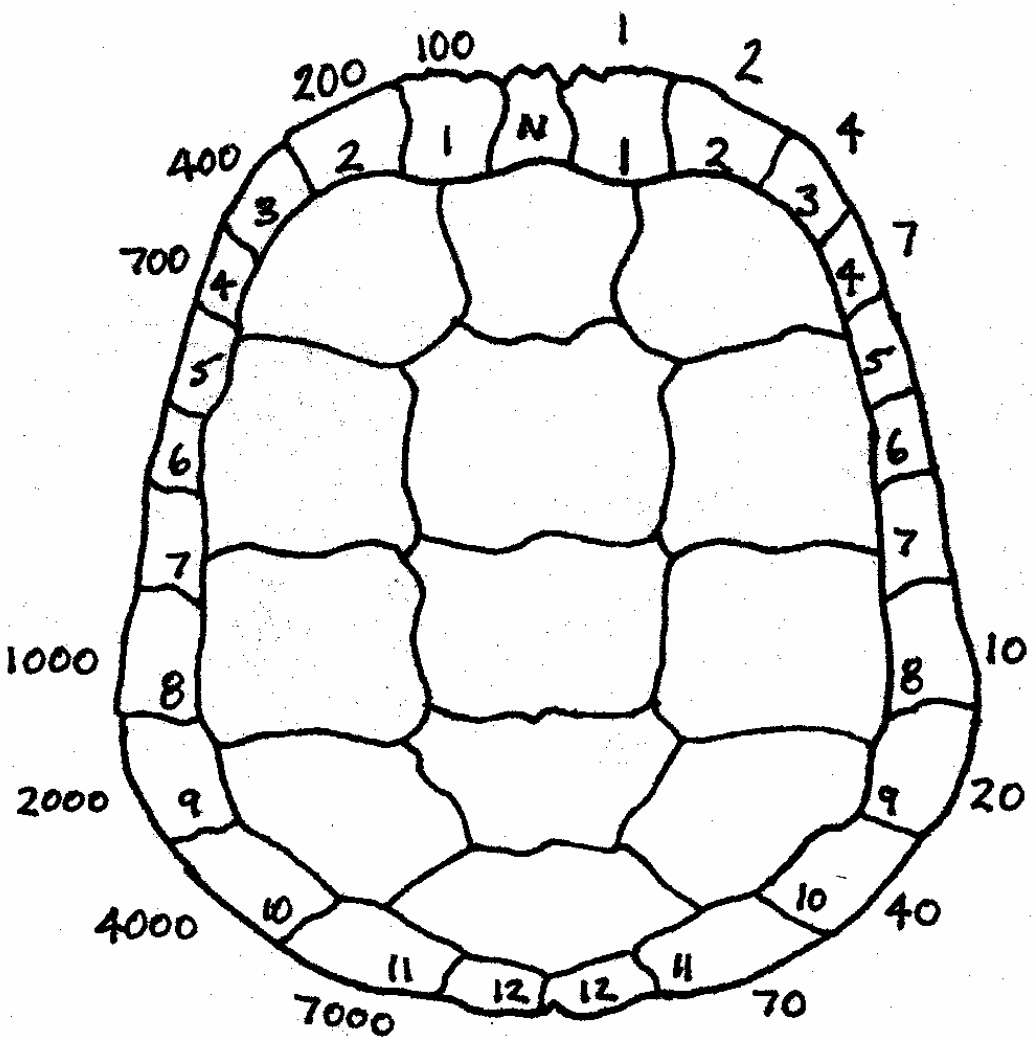
The effect of seasonality (April – July v. August – September) and coverboard type (wood v. sheet metal) on captures was tested using chi-square analysis (Sokal and Rohlf 1987). All snakes captured, under coverboards or thru any other means had their snout vent length (mm), total length (mm), and weight (g) measured.

Turtle Traps

Welded-wire crab traps measuring 30.5cm x 30.5cm x 60.1cm (12"x12"x 24"), with a mesh size of 1.3cm x 2.5cm (0.5" x 1"), were primarily used to sample shallow pond areas for small aquatic/semi-aquatic turtles, while funnel traps made of D-shaped metal hoops and 2.6cm (1") nylon mesh were used to sample deeper pond areas for aquatic turtles such as painted (*Chrysemys picta*) and snapping turtles (*Chelydra serpentina*) (Harless and Morlock 1989). Traps, baited with sardines in vegetable oil, were set for three to nine day periods between 23 April - 29 June 2001 at 11 ponds total, 10 on Mount Desert Island and one pond site on Isle au Haut. Seven to 14 traps were set at a pond depending on its size and the amount of suitable habitat. Traps were checked at least every other day.

Turtles captured in traps and during incidental encounters were measured, weighed, and marked. Maximum carapace length and width, plastron length, and plastron width (across the points where the pectoral and abdominal scutes join the bridge at the inframarginal scute)

were measured. Each turtle was assigned a unique, individual identification number and, using a three-sided file, triangular notches were made on marginal scutes, to represent that number (Cagle 1939, Fig. 2). Photos of the carapace and plastron of most turtles were taken and may be used for identification in future studies (datasheets Volume II).



- The marginal scutes are numbered 1-12 on the right side and 1-12 on the left side, and are abbreviated as R1 for right side, marginal scute #1, L1 for left side, marginal scute #1, etc.
- Numbers on the perimeter of the shell represent the numerical value assigned to each marginal scute. These numbers include 1, 2, 4, 7, 10,20,40,70,100,200,400,700,1000,2000,4000,and 7000.
- Using this system, the values for each marginal scute are as follows:

R1=1	R8=10	L1=100	L8=1000
R2=2	R9=20	L2=200	L9=2000
R3=4	R10=40	L3=400	L10=4000
R4=7	R11=70	L4=700	L11=7000

- Using a file, each turtle received a unique combination of marginal scute notches to represent a numerical value unique to each individual.

For example: A turtle that is notched R1, L1 has a numerical notch code value of 101. This is accomplished by adding the value for R1=1 with L1=100. In this way, multiple combinations of notches can create thousands of numerical values to represent individual turtles.

Figure 2. Dorsal view of a turtle shell carapace, illustrating the notch code system used to mark turtles (Cagle 1939).

Abundance was quantified in two ways. An index of abundance (IA) was calculated as the total number of unique individuals trapped relative to the total number of trap nights. Number of trap nights is the number of traps deployed at a site multiplied by the number of nights the traps were set. Such indices allow comparisons of abundance between sites with different trapping effort. However, they will be biased if capture probabilities vary due to time, space, or species (Pollock et al. 1990). We calculated the number of turtles captured per 100 trap nights (catch/100 trap nights) as:

$$IA = \frac{(\text{\# of individual turtles captured})}{(\text{total \# of trap nights})} \times 100.$$

To provide population estimates where potential differences in catchability are accounted for, population size at 11 ponds was estimated using Chapman's modified Lincoln-Petersen Index (Pollock et al. 1990), based on both trap and incidental (hand) captures. The formula is:

$$N=((n_1+1)(n_2+1)/(m_2+1))-1, \text{ where}$$

N=Population Estimate
n_1 = # of turtles marked in the first half of the sampling period
n_2 = # of turtles marked in the second half of the sampling period
m_2 = # of turtles marked in the first half and caught in the second half of the sampling period.

Minnow Traps

Collapsible mesh minnow traps measuring 15.2cm x 15.2cm x 30.5cm (6"x 6"x 12") were used to sample shallow pond areas for adult and larval salamanders, adult and larval anurans, and aquatic snakes (Heyer et al. 1994). Three to six traps were deployed at 12 sites, 11 on Mount Desert Island and one on Isle au Haut for two to 17 day periods from 17 April - 29 June 2001. Traps were checked at least every other day. Since this method primarily captures amphibians, which were not marked for individual recognition, abundance was quantified as total captures (rather than unique individuals) per 100 trap nights.

Drift Fencing

In an effort to capture four-toed salamanders (*Hemidactylium scutatum*), as well as other amphibians and reptiles in this waterlogged, moss-dominant wetland, drift fences were installed at Sunken Heath. Two drift fence arrays were installed, along the edge of the pond in the center of the heath. One "T" shaped array, measuring approximately 50 m, with a wing measuring approximately 60 m extending to the north, was installed at the western end of the pond. The second array, a "Y" shaped array with three wings measuring ca. 30 m each

radiating out from a central pitfall trap, was installed at the northern end of the pond. The two arrays contained a total of 32 funnel and 17 pitfall traps (Heyer et al. 1994; Fig. 3). The drift fence was constructed of heavy-duty plastic sheeting stapled to wooden stakes. It extended 12" above the surface, and 6" below the surface. Rigid plastic minnow traps, set against the fence, were used as funnel traps, and pitfall traps, made of two #10 cans taped together, were installed at wing junctions and at the end of each wing.

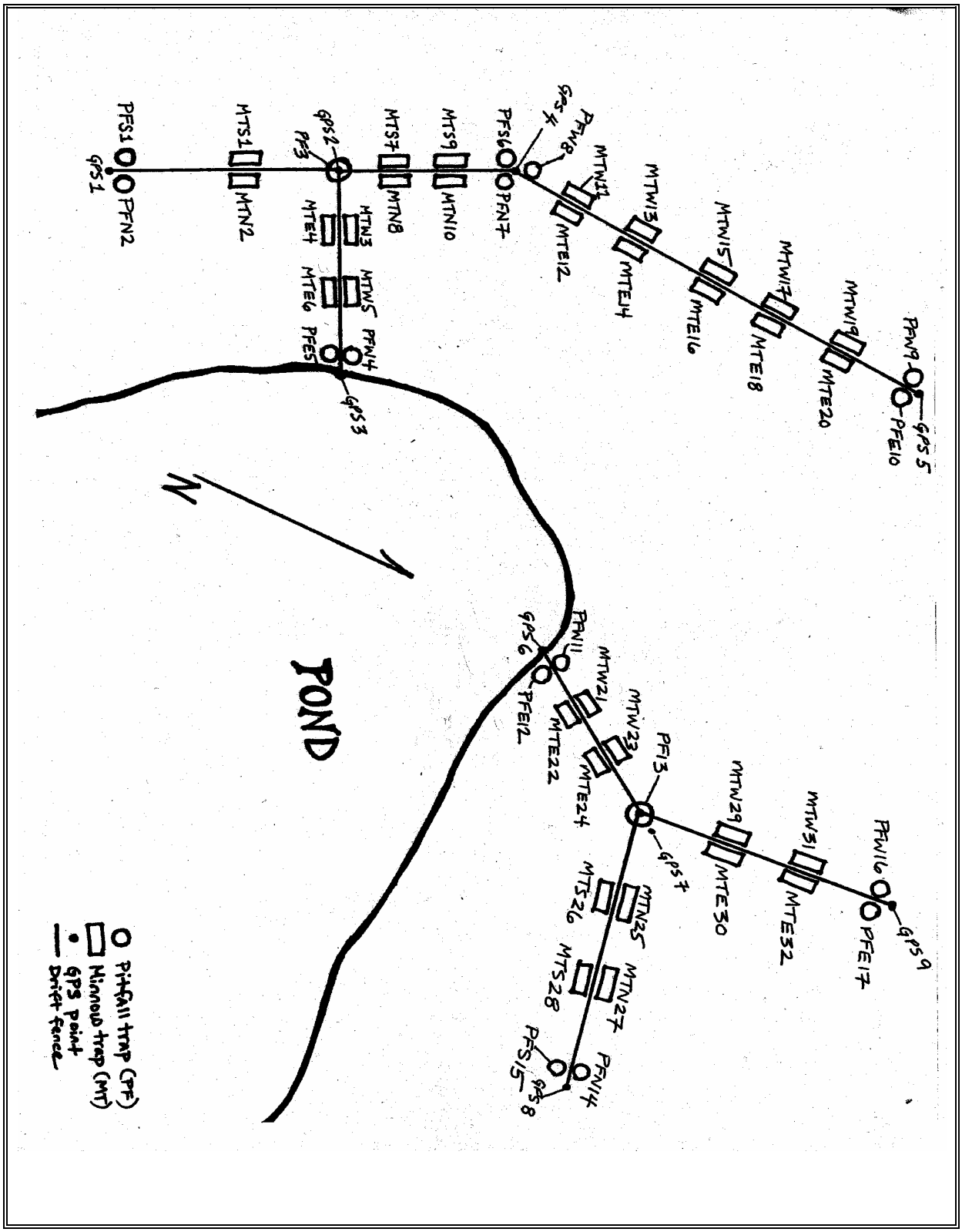


Figure 3. Sunken Heath Drift Fence Arrays. Values for the GPS location points are listed in Appendix 6. Codes used for traps are described at MT=minnow/funnel trap and PF=pitfall trap.

Drift fence arrays were monitored at least every other day between 12 April - 21 May 2001. For all species captured, abundance was quantified as total captures (rather than unique individuals) per 100 trap nights.

Incidental Encounters

Any encounter with an amphibian or reptile not recorded as data in one of the standardized surveys was considered an incidental encounter. These were recorded on observation cards ("Green Cards") to augment data collected during formal surveys, and include observations made by park staff and visitors. For each incidental encounter, species, life stage, method of documentation, as well as location, habitat, and UTM coordinates were recorded, though some of these data were sometimes missing from visitor reports.

Data Storage

Data collected during the course of this study are stored on computer disk attached to this report. The original data sheets (Volumes I, II, and III) are archived in the Acadia National Park Natural History Museum, and copies of the original data sheets are on file in the Wildlife Conservation Society's Department of Herpetology, Bronx, NY.

Results

Overview of Park Herpetofauna

A total of 18 species, 11 amphibian and seven reptiles were recorded. Amphibians dominated the herpetofaunal community, accounting for 88% of the 5055 individuals recorded. By taxonomic group, anurans comprised 67% of all individuals, salamanders 21%, turtles 7%, and snakes 5%. The most abundant species in each taxonomic group, based on total numbers of adults recorded were spring peeper (*Pseudacris crucifer*), spotted salamander, painted turtle, and common garter snake (*Thamnophis sirtalis*) (Table 1). Geographically, the majority of individuals were recorded on Mount Desert Island. All eighteen species were recorded on Mount Desert Island, with 10 recorded from Isle au Haut, two from Bar Island, and one from Schoodic Peninnsula (Table 1). Species recorded on both Mount Desert Island and Isle au Haut were spring peeper, pickerel frog (*Rana palustris*), wood frog, spotted salamander, eastern red-backed salamander (*Plethodon cinereus*), red-spotted newt (*Notophthalmus v. viridescens*), common garter snake, smooth green snake (*Opheodrys vernalis*), northern red-bellied snake (*Storeria o. occipitomaculata*), and northern ring-necked snake (*Diadophis punctuatus edwardsii*)(Tables 1 and 2). Painted and snapping turtles, the only turtles recorded, were only recorded on Mount Desert Island, though painted turtles have been reliably reported on Isle au Haut.

Table 1. Number of adult amphibians and reptiles encountered during all surveys, by park sectors and habitat category in Acadia National Park, March to September 2001. MDI = Mount Desert Island; IAH = Isle au Haut; SP = Schoodic Peninsula; BI = Bar Island. Relative Abundance (RA) is number of individuals/species divided by total number of adults of all species (n=5055).

	Number of Adults Recorded										
	By Sector				By Habitat Category					Total	RA (Rank)
Species	**MDI**	**IAH**	**SP**	**BI**	**Stream**	**Wetland**	**Upland**	**Road**	**Tidal**		
FROGS											
Spring Peeper	1729	7	0	0	6	1514	27	183	6	1736	0.34 (1)
Northern Green Frog	618	0	0	0	35	565	1	10	7	618	0.12 (3)
American Bullfrog	446	0	0	0	0	441	0	3	2	446	0.09 (4)
Pickerel Frog	325	1	0	0	8	285	3	30	0	326	0.06 (5)
Wood Frog	241	12	0	0	2	238	2	11	0	253	0.05 (7)
American Toad	17	0	0	0	0	15	1	1	0	17	<0.01 (16)
SALAMANDERS											
Spotted Salamander	449	344	1	0	15	724	1	45	9	794	0.16 (2)
Eastern Red-backed Salamander	137	2	0	0	22	8	53	56	0	139	0.03 (8)
Red-Spotted Newt	51	1	0	0	2	39	0	11	0	52	0.01(11)
Northern Two-lined Salamander	41	0	0	0	38	2	1	0	0	41	0.01 (14)
Four-toed Salamander	22	0	0	0	0	15	0	7	0	22	<0.01 (15)
TURTLES											
Painted Turtle	290	0	0	0	0	272	0	4	14	290	0.06 (6)
Snapping Turtle	86	0	0	0	0	64	0	10	12	86	0.02 (10)
SNAKES											
Common Garter Snake	112	25	0	1	1	51	38	47	1	138	0.03 (9)
Smooth Green Snake	19	28	0	0	0	5	30	12	0	47	0.01 (12)
Northern Red-bellied Snake	37	5	0	1	0	11	26	6	0	43	0.01 (13)
Eastern Milk Snake	11	0	0	0	0	2	3	6	0	11	<0.01 (17)
Northern Ring-necked Snake	4	1	0	0	0	1	2	2	0	5	<0.01 (18)
TOTAL # ADULTS	4626	426	1	2	129	4243	188	444	51	5055	
TOTAL # SPECIES	18	10	1	2	9	18	14	17	3	18	

Table 2. Distribution by park sector and habitat category of the 18 species of amphibians and reptiles recorded in Acadia National Park, March to September 2001. Based on number of localities at which a species was recorded. MDI=Mount Desert Island; IAH=Isle Au Haut; SP=Schoodic Peninsula; BI=Bar Island. Frequency of Occurrence (FO) is number of localities a species was recorded from divided by total number (281). Number of localities includes both standardized survey sites and incidental encounter locations.

	Number of Localities Recorded										
	By Sector				By Habitat Category					Total	FO
Species	**MDI**	**IAH**	**SP**	**BI**	**Stream**	**Wetland**	**Upland**	**Road**	**Tidal**		
FROGS											
Spring Peeper	70	1	0	0	2	51	3	14	1	71	0.25
Northern Green Frog	65	0	0	0	5	51	2	6	1	65	0.23
Pickerel Frog	50	1	0	0	4	38	2	7	0	51	0.18
American Bullfrog	36	0	0	0	0	33	0	2	1	36	0.13
Wood Frog	21	5	0	0	1	17	2	6	0	26	0.09
American Toad	7	0	0	0	0	5	1	1	0	7	0.02
SALAMANDERS											
Spotted Salamander	46	15	1	0	4	42	1	14	1	62	0.22
Eastern Red-backed Salamander	33	2	0	0	6	6	8	15	0	35	0.12
Red-Spotted Newt	16	1	0	0	2	11	0	4	0	17	0.06
Four-toed Salamander	9	0	0	0	0	6	0	3	0	9	0.03
Northern Two-lined Salamander	8	0	0	0	6	1	1	0	0	8	0.03
TURTLES											
Painted Turtle	29	0	0	0	0	23	0	5	1	29	0.10
Snapping Turtle	29	0	0	0	0	18	0	10	1	29	0.10
SNAKES											
Common Garter Snake	74	22	0	1	1	33	23	39	1	97	0.35
Smooth Green Snake	11	15	0	0	0	5	11	10	0	26	0.09
Northern Red-bellied Snake	14	4	0	1	0	6	7	6	0	19	0.07
Eastern Milk Snake	11	0	0	0	0	2	3	6	0	11	0.04
Northern Ring-necked Snake	4	1	0	0	0	1	2	2	0	5	0.02
TOTAL # OF LOCALITIES	227	52	1	1	18	123	41	96	3	281	

Of the 281 localities (120 standardized sample points plus 161 incidental encounter locations) at which animals were captured, 227 were located on Mount Desert Island, 52 on Isle au Haut, and one each on Bar Island and Schoodic Peninsula. Based on Frequency of Occurrence, the most widespread species in each taxonomic group was spring peeper (70 or 25% of all localities), spotted salamander (62 or 22%), painted turtle (30 or 11%), and common garter snake (97 or 35%) (Table 2).

By habitat, relative abundance (number of adults) was greatest in wetland (84% of individuals recorded), followed by road (9%), upland (4%), stream (2%), and tidal (1%) (Table 1). Species richness followed the same pattern, with all 18 species recorded in wetland habitats, 17 on roads, 14 in uplands, nine in streams, and seven species in tidal habitats (Table 1, Fig. 4). Within each of the five habitat categories, species richness was greatest in permanent ponds, lakes, and beaver ponds (18 species, 100% of recorded species), on paved roads (15 species), in fields (11 species), intermittent streams (7 species) and tidal marshes (5 species) (Fig. 4).

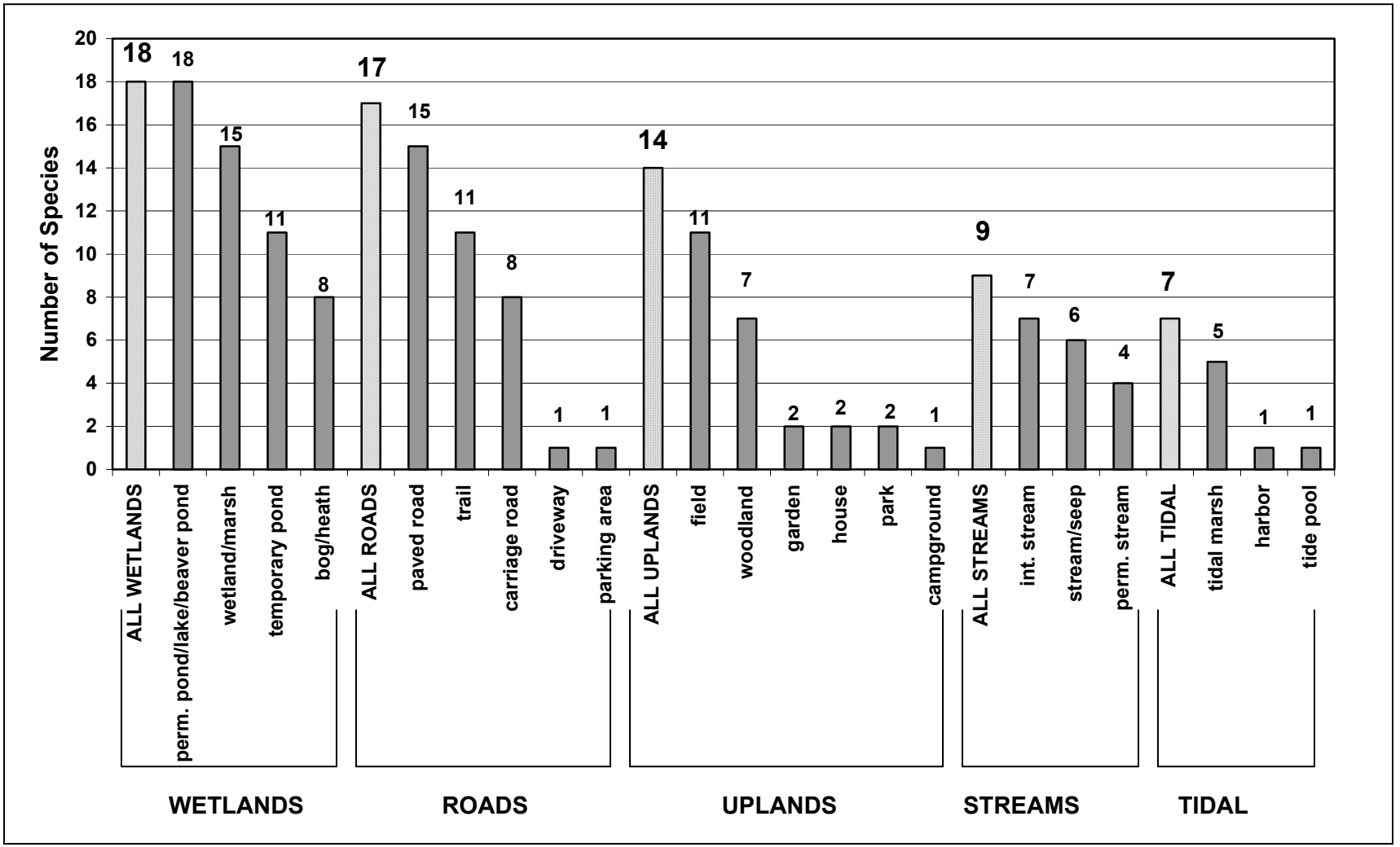


Figure 4. Species richness for each habitat category and type surveyed in Acadia National Park in 2001. See Appendix 2 for habitat descriptions.

Survey Method Summaries

All 18 amphibian and reptile species detected during this survey were recorded as incidental encounters (Table 3a and 3b). Incidental encounters accounted for more individuals than any other method (42% of all adult form individuals recorded) and, for 11 of the 18 species, was the most productive method (i.e. produced the greatest numbers of individuals) (Table 4). Of the standardized surveys, Wetland/Pond TCS produced the greatest number of species (nine), 8% of all individuals recorded, and was the most productive method for one species (pickerel frog). Conversely, six species, 31% of all individuals recorded, were detected with Anuran Call Counts, and was the most productive method for two species (spring peeper and American toad (*Bufo a. americanus*)). Minnow Traps recorded eight species, 2% of all individuals recorded, and was the most productive method for one species (red-spotted newt). Woodland/Field TCS produced seven species, 1% of all individuals, and was not a highly productive method for any species. Stream TCS and Coverboards each produced five species, accounted for 1% of all individuals recorded, and were the most productive methods for two-lined salamanders and red-bellied snakes respectively. Drift fence trapping produced four species, 1% of all individuals, and was not very productive. Egg-mass counts produced three species, 10% of all individuals, and was the most productive method for wood frog. Turtle traps produced two species, 2% of all individuals, and were moderately productive.

Table 3a. Number of amphibians recorded by each survey method in Acadia National Park from March to September, 2001. Survey methods are: ACC=Anuran Call Count; EMC=Egg Mass Count; TCS=Time Constrained Search; MT=Minnow Trap; DF=Drift Fence; and IE=Incidental Encounter. Life stage of animals is: A=Adult; J=Juvenile; L=Larvae; E=Egg; N=Nest.

SURVEY METHOD		SPECIES																							# of Amphibian Species
		Spring Peeper		Northern Green Frog		Pickerel Frog		American Bullfrog		Wood Frog			American Toad	Spotted Salamander			Eastern Red-backed Salamander	Red-spotted Newt		Four-toed Salamander		Northern Two-lined Salamander			
		A	L	A	L	A	E[2]	A	L	A	L	E[2]	A	A	L	E[2]	A	A	J	A	N	A	L	N	
ACC[1]		1321	-	136	-	70	-	44	-	2	-	-	10	-	-	-	-	-	-	-	-	-	-	-	6
EMC		-	-	-	-	-	1	-	-	-	-	216	-	-	-	313	-	-	-	-	-	-	-		3
TCS	stream	-	-	2	-	3	-	-	-	-	-	-	-	-	-	-	15	-	2	-	-	37	7	1	5
	woodland/ field	-	-	2	-	1	-	-	-	-	-	-	1	-	-	-	35	-	-	-	-	1	-	-	5
	wetland/ pond	2	-	139	10	131	-	80	6	-	-	-	-	-	-	65	4	1	2	-	-	-	-	-	7
MT		3	5	5	127	1	-	1	83	-	40	-	-	38	8	4	-	25	-	-	-	-	-	-	7
DF		30	-	-	-	1	-	-	-	-	-	-	-	13	-	-	-	-	-	-	-	-	-	-	3
IE[3]		380	-	334	32	118	4	321	179	34	101	1	6	37	-	324	85	13	9	22	7	3	-	-	11
Total		1736	5	618	169	325	5	446	268	36	141	217	17	88	8	706	139	39	13	22	7	41	7	1	11

[1]Amphibian Call Count numbers (A) represent the estimated number of males calling.

[2] E=estimated number of adult males (frogs) or adult females (salamanders) based on number of egg masses.

[3] The adult stage for Incidental Encounters represents adults, juveniles, and animals of unknown stage.

Table 3b. Number of reptiles recorded by each survey method in Acadia National Park from March to September, 2001. Survey methods are: TCS=Time Constrained Search; CB=Coverboard; TT=TurtleTrap; MT=Minnow Trap; DF=Drift Fence; and IE=Incidental Encounter. Life stage of animals is adult.

SURVEY METHOD		SPECIES							
		Painted Turtle	Snapping Turtle	Common Gartersnake	Smooth Greensnake	Northern Red-bellied Snake	Eastern Milksnake	Northern Ring-necked Snake	# of Reptilian Species
TCS	woodland/ field	-	-	4	-	1	-	-	2
	wetland/ pond	-	-	4	-	1	-	-	2
CB				24	8	28	1	1	5
TT		61	40	-	-	-	-	-	2
MT		1	-	-	-	-	-	-	1
DF		-	-	-	-	1	-	-	1
IE		228	46	106	39	12	10	4	7
TOTAL		290	86	138	47	43	11	5	7

Table 4. Percentage of adult form individuals of each species detected by each survey method. Derived from Tables 3a and 3b.

	Spring Peeper	Northern Green Frog	Pickerel Frog	American Bullfrog	Wood Frog	American Toad	Spotted Salamander	Eastern Red-backed Salamander	Red-spotted Newt	Northern Two-lined Salamander	Four-toed Salamander	Eastern Painted Turtle	Snapping Turtle	Common Gartersnake	Smooth Greensnake	Northern Red-bellied Snake	Eastern Milksnake	Northern Ring-necked Snake	Total # Inds	%Total	#Spp
ACC	76%	22%	21%	10%	1%	59%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1583	31%	6
EMC	0%	0%	0%	0%	86%	0%	39%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	530	10%	3
TCS Stream	0%	0%	1%	0%	0%	0%	0%	11%	4%	90%	0%	0%	0%	0%	0%	0%	0%	0%	59	1%	5
TCS Upland	0%	0%	0%	0%	0%	6%	0%	25%	0%	2%	0%	0%	0%	3%	0%	2%	0%	0%	45	1%	7
TCS Wetland	0%	23%	40%	18%	0%	0%	8%	3%	6%	0%	0%	0%	0%	3%	0%	2%	0%	0%	429	8%	9
CB	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	17%	17%	65%	9%	20%	62	1%	5
TT	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	21%	47%	0%	0%	0%	0%	0%	101	2%	2
MT	0%	1%	0%	0%	0%	0%	5%	0%	48%	0%	0%	0%	0%	0%	0%	0%	0%	0%	78	2%	8
DF	2%	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	2%	0%	0%	45	1%	4
IE	22%	53%	36%	72%	13%	35%	45%	61%	42%	7%	100%	79%	53%	77%	83%	28%	91%	80%	2123	42%	18
%Total Inds	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100		100%	
Total # Inds	1736	618	326	446	253	17	794	139	52	41	22	290	86	138	47	43	11	5	5055		18

Anuran Call Counts

Six species were recorded using anuran call counts. Of these, the spring peeper is the most widely distributed anuran in Acadia. It was recorded at 76% of the 59 sites surveyed during amphibian-call counts, followed by the northern green frog (*Rana clamitans melanota*) (44% of sites), pickerel frog (25% of sites), American bullfrog (*Rana catesbeiana*) (22% of sites), American toad (5% of sites), and wood frog (3% of sites) (Table 5). However, since the number of sampling events at sites was unequal and there was a significant correlation between the number of times a site was sampled and the number of species recorded at a site ($r=0.502$, $p=0.002$), as well as a predominance of sampling in the spring, the number of species recorded at many sites, particularly those with peak calls in summer, is under-represented. Thus, the above numbers are underestimates. Spring peepers were most abundant, attaining a maximum call index value of three at 35 of the 45 sites at which they were recorded. The only other species to attain a maximum call index of three was northern green frog, at two of 26 sites. Pickerel frog, American bullfrog, and American toad each attained a maximum call index value of two, at four of 15, four of 13, and one of three sites respectively. Wood frogs attained a maximum call index value of one, at two sites (Tables 6 and 7).

Table 5. Summary of anuran distribution, by park sector, as determined by call count surveys. Number of sites in each of three sectors where anurans were recorded during call counts in Acadia National Park, 16 April to 19 June 2001. Frequency of Occurrence is number of sites a species was calling from divided by total number of sites surveyed (59).

Park Sector (# sites)	Species						Species Richness
	Spring Peeper	Northern Green Frog	Pickerel Frog	American Bullfrog	American Toad	Wood Frog	
East Side Mount Desert Island (37)	25	16	7	12	0	2	**5**
West Side Mount Desert Island (21)	19	10	8	1	3	0	**5**
Isle au Haut (1)	1	0	0	0	0	0	**1**
Total # of Sites Recorded	**45**	**26**	**15**	**13**	**3**	**2**	
Highest Call Index	**3**	**3**	**2**	**2**	**2**	**1**	
Frequency of Occurrence	**76.3**	**44.1**	**25.4**	**22.0**	**5.1**	**3.4**	

Table 6. Species richness and maximum anuran call count index value recorded at 37 call count sites on the east side of Mount Desert Island from 16 April to 19 June 2001. (CI)=maximum call index recorded, and (#)=the number of times a species was encountered. Frequency of Occurrence is number of sites a species was calling from divided by total number of sites surveyed (37).

Site	# Times Surveyed	Species												Species Richness
		Spring Peeper		Northern Green Frog		American Bullfrog		Pickerel Frog		Wood Frog		American Toad		
		CI	#	CI	#	CI	#	CI	#	CI	#	CI	#	
Aunt Betty Pond	2	3	2	1	1	2	2	1	1	-	-	-	-	**4**
Beaver Dam / Muck Pond	5	3	4	1	1	-	-	-	-	-	-	-	-	**2**
Blackwoods Wetland	2	3	2	-	-	-	-	-	-	-	-	-	-	**1**
Brewer Mt. Marsh	1	-	-	2	1	1	1	-	-	-	-	-	-	**2**
Bubble Pond	1	-	-	-	-	-	-	-	-	-	-	-	-	**0**
Duck Brook Road	2	3	2	-	-	-	-	1	1	-	-	-	-	**2**
Duck Brook Road Bridge Pond	1	-	-	-	-	-	-	-	-	-	-	-	-	**0**
Duck Brook Road Marsh	1	3	1	-	-	-	-	-	-	-	-	-	-	**1**
Duck Brook Road Pond	1		-	1	1	2	1	-	-	-	-	-	-	**2**
Dudley Pond	4	3	4	-	-	-	-	-	-	-	-	-	-	**1**
Eagle Lake SE Marsh	1	3	1	1	1	-	-	-	-	-	-	-	-	**2**
East Marsh	1	-	-	3	1	-	-	-	-	-	-	-	-	**1**
Geronimo Pond	1	-	-	-	-	1	1	-	-	-	-	-	-	**1**
Gilmore Meadow	2	3	2	3	2	2	2	1	1	-	-	-	-	**4**
Great Meadow	4	3	3	-	-	1	1	1	1	-	-	-	-	**3**
Half Moon Pond	1	-	-	2	1	1	1	-	-	-	-	-	-	**2**
Halfway Marsh	1	-	-	1	1	-	-	-	-	-	-	-	-	**1**
Jordan Pond	1	2	1	-	-	-	-	-	-	-	-	-	-	**1**
Little Turtle Pond	1	3	1	-	-	-	-	-	-	-	-	-	-	**1**
Lower Hadlock Pond	1	-	-	-	-	-	-	-	-	-	-	-	-	**0**
North Breakneck Pond	2	3	1	-	-	-	-	-	-	-	-	-	-	**1**
Owens Stone Barn	1	3	1	-	-	-	-	-	-	1	1	-	-	**2**
Park Loop Road Site #1	1	2	1	-	-	-	-	-	-	-	-	-	-	**1**
Park Loop Road Site #2	1	3	1	-	-	-	-	-	-	-	-	-	-	**1**

Table 6. Species richness and maximum anuran call count index value recorded at 37 call count sites on the east side of Mount Desert Island from 16 April to 19 June 2001. (CI)=maximum call index recorded, and (#)=the number of times a species was encountered. Frequency of Occurrence is number of sites a species was calling from divided by total number of sites surveyed (37) (continued).

Site	# of Times Surveyed	Species												Species Richness
		Spring Peeper		Northern Green Frog		American Bullfrog		Pickerel Frog		Wood Frog		American Toad		
		CI	#	CI	#	CI	#	CI	#	CI	#	CI	#	
Park Loop Road Site #3	1	2	1	-	-	-	-	-	-	-	-	-	-	**1**
Sand Beach Wetland	4	3	4	2	2	1	1	2	2	-	-	-	-	**4**
Schooner Head Wetland	5	3	4	2	2	-	-	-	-	1	1	-	-	**3**
South Breakneck Pond	2	3	2	-	-	2	2	1	1	-	-	-	-	**3**
SE of Bowl/Kief Pond	1	-	-	2	1	-	-	-	-	-	-	-	-	**1**
Sunken Heath	1	3	1	-	-	-	-	-	-	-	-	-	-	**1**
The Bowl	1	-	-	-	-	1	1	-	-	-	-	-	-	**1**
The Tarn	3	3	3	2	1	-	-	-	-	-	-	-	-	**2**
Upper Hadlock Pond	1	3	1	-	-	-	-	-	-	-	-	-	-	**1**
Upper Precipice Beaver Pond	2	2	2	-	-	-	-	1	1	-	-	-	-	**2**
Wetland after Halfway Marsh	1	1	1	1	1	-	-	-	-	-	-	-	-	**2**
Wetland past East Marsh	1	-	-	1	1	1	1	-	-	-	-	-	-	**2**
Witch Hole Pond	2	3	2	1	1	1	1	-	-	-	-	-	-	**3**
Number of sites with species calling		**25**		**16**		**12**		**7**		**2**		**0**		
Frequency of Occurrence		**67.6**		**43.2**		**32.4**		**18.9**		**5.4**		**0.0**		

Table 7. Species richness and maximum anuran call count index value recorded at 21 sites on the west side of Mount Desert Island, 16 April to 19 June 2001. (CI)=the highest call index recorded, and (#)=the number of times a species was encountered. Frequency of Occurrence is number of sites a species was calling from divided by total number of sites surveyed (21).

Site	# of Times Surveyed	Species												Species Richness
		Spring Peeper		Northern Green Frog		Pickerel Frog		American Toad		American Bullfrog		Wood Frog		
		CI	#	CI	#	CI	#	CI	#	CI	#	CI	#	
Bass Harbor Marsh	2	3	2	2	1	2	1	2	1	-	-	-	-	**4**
Big Heath	2	3	2	1	1	-	-	-	-	-	-	-	-	**2**
Duck Pond	2	3	2	-	-	-	-	-	-	-	-	-	-	**1**
Echo Lake Wetland	1	2	1	-	-	-	-	-	-	-	-	-	-	**1**
Heath Brook Wetland	1	1	1	1	1	-	-	-	-	-	-	-	-	**2**
Hio Road Wetland	1	1	1	-	-	-	-	1	1	-	-	-	-	**2**
Hodgdon Pond	4	3	4	1	2	2	2	-	-	1	1	-	-	**4**
Hodgdon Road Pond	3	3	2	1	2	-	-	-	-	-	-	-	-	**2**
Long Pond Fire Road Wetland #1	1	2	1	-	-	-	-	-	-	-	-	-	-	**1**
Long Pond Fire Road Wetland #2	1	3	1	-	-	1	1	-	-	-	-	-	-	**2**
Mill Reservoir	1	-	-	-	-	-	-	-	-	-	-	-	-	**0**
Oak Hill Road Wetland	1	3	1	-	-	1	1	-	-	-	-	-	-	**2**
Round Pond	3	3	3	-	-	1	3	-	-	-	-	-	-	**2**
Route 102, west of Ripples Pond	1	3	1	-	-	1	1	-	-	-	-	-	-	**2**
Seal Cove Coverboard Wetland	2	3	1	2	1	-	-	1	1	-	-	-	-	**3**
Seal Cove Pond	4	3	4	1	1	2	2	-	-	-	-	-	-	**3**
Seawall Pond	1	3	1	1	1	-	-	-	-	-	-	-	-	**2**
Seawall Pond #2	1	3	1	-	-	-	-	-	-	-	-	-	-	**1**
Somes Pond Wetland	2	3	2	1	1	1	1	-	-	-	-	-	-	**3**
Valley Cove Pond	1	-	-	1	1	-	-	-	-	-	-	-	-	**1**
Western Mt./ Lurvey Pond	2	3	2	-	-	-	-	-	-	-	-	-	-	**1**
Number of sites with species calling		**19**		**10**		**8**		**3**		**1**		**0**		
Frequency of Occurrence		**90.5**		**47.6**		**38.1**		**14.3**		**4.8**		**0.0**		

Based on call count index values, Gilmore Meadow and Bass Harbor Marsh had the greatest anuran species richness and abundance. Species and maximum call indices recorded at Gilmore Meadow were spring peeper (3), northern green frog (3), American bullfrog (2), and pickerel frog (1)(Table 6) and at Bass Harbor Marsh they were spring peeper (3), northern green frog (2), pickerel frog (2), and American toad (2)(Table 7). Other sites with four anuran species recorded during anuran call counts were Aunt Betty Pond, Sand Beach Wetland, and Hodgdon Pond (Tables 6 and 7). Of the 59 sites, five had four species recorded, seven had three, 20 had two, 22 had one, and four had no species recorded.

Geographically, spring peeper, northern green frog, and pickerel frog were widespread. The American bullfrog was overwhelmingly on the east side of Mount Desert Island and American toad was only recorded on the west side. Wood frog was only recorded on the east side of Mount Desert Island (though wood frog egg masses were identified on the west side as incidental encounters). The spring peeper was the only anuran found during anuran call counts on Isle au Haut (Table 5).

Egg-Mass Counts

Of the 18 ponds surveyed, spotted salamander eggs were detected at 13 (72%), wood frog at 5 (28%) and pickerel frog at 1 (6%). Geographically, frequency of occurrence was highest on Isle of Haut, with spotted salamander eggs recorded in three of three (100%) ponds and wood frog in two of three (67%). On Mount Desert Island, spotted salamander eggs were found in 10 of 15 (67%) of ponds, wood frog in three of 15 (20%), and pickerel frog in one of 15 (7%).

One pickerel frog, 495 spotted salamander, and 216 wood frog egg masses were recorded in 15 of the 18 ponds surveyed. No egg masses of any species were recorded from Bubble Pond, Seal Cove Road Pond, nor Seawall Pond (Table 8) nor were spotted salamander spermatophores observed during any egg mass count. For sites where detected, the mean number of spotted salamander egg masses was 38.1 (sd=86.5) and wood frog egg masses was 72 (sd=105). For both of these species, only a couple of ponds accounted for most of the egg masses counted. Duck Pond and Isle au Haut Pond Site 1 accounted for 74% of all spotted salamander eggs counted, and Seal Cove Coverboard Wetland 93% of all wood frog egg masses (Table 8).

Table 8. Number of egg masses recorded during egg-mass counts at 18 sites in Acadia National Park, 20 April to 16 May 2001.

Site	Number of Counts	Species		
		Spotted Salamander	Wood Frog	Pickerel Frog
Big Heath Pond	2	19	2	-
Bubble Pond	1	-	-	-
Duck Pond	1	171	-	1
Dudley Pond	1	6	-	-
Entrance Station Pond	1	34	-	-
Isle au Haut Pond Site 1	1	195	8	-
Isle au Haut Pond Site 3	1	15	1	-
Isle au Haut Pond Site 6	1	>10	-	-
Little Precipice Beaver Pond	1	22	-	-
Little Turtle Pond	2	4	-	-
Lower Precipice Beaver Pond	1	2	-	-
North Breakneck Pond	1	8	-	-
Schooner Head Wetland	1	1	-	-
Seal Cove Coverboard Wetland	2	-	199	-
Seal Cove Road Pond	1	-	-	-
Seawall Pond	1	-	-	-
Sunken Heath Vernal Pond	1	-	6	-
Upper Precipice Beaver Pond	1	8	-	-
Total	**21**	**495**	**216**	**1**

Time-Constrained Search (TCS)

Stream TCS

Five species were detected during stream TCS at 10 sites. The northern two-lined salamander (*Eurycea bislineata*) was the most widespread species, recorded at five of 10 (50%) stream sites surveyed, followed by eastern red-backed salamander (40% of sites), and pickerel frog, red-spotted newt, and northern green frog (20% of sites) (Table 9). Northern two-lined salamanders were also the most abundant stream species, with an adult Index of Abundance of 2.8 adult/search hour. Red-backed salamanders were the second most abundant species recorded during Stream TCS (IA=1.1), though they were found primarily along the stream bank (zone 3) rather than in the stream channel (zone 1) (Table 10). Pickerel frog, red-spotted newt and northern green frog were least abundant (IA=0.2) (Table 9). The only northern two-lined salamander nest observed was at Heath Brook. Hadlock Stream and Richardson's Brook Site #2 had the greatest species richness with three species identified at each site. The only species recorded on Isle au Haut was red-backed salamander, at Isle au Haut Stream Site #5 (Table 9). The majority of amphibians were captured in stream zone two (58% of individuals) (Table 10), under cobble substrate (61% of individuals) (Table 11).

Table 9. Number of amphibians recorded during stream time-constrained surveys at 10 sites on Acadia National Park, 11 May to 13 August 2001. Index of Abundance (IA) is number of individuals divided by total search effort described in Appendix 4.

Site (search hrs)	Species								Species Richness[1]
	Northern Two-lined Salamander			Red-backed Salamander	Pickerel Frog	Red-spotted Newt	Northern Green Frog	Ranid spp.	
	Adult	Larvae	Nest	Adult	Adult	Eft	Adult	Adult	
Duck Pond Stream North (1.8)	-	-	-	7	1	-	-	-	**2**
Duck Pond Stream South (0.6)	-	-	-	-	-	-	1	-	**1**
Gorge Trail Stream (1.1)	2	-	-	-	-	-	-	-	**1**
Hadlock Stream (3.0)	6	-	-	-	2	1	-	-	**3**
Heath Brook (2.3)	1	5	1 nest	-	-	-	-	-	**1**
Isle au Haut Stream Site #2 (0.8)	-	-	-	-	-	-	-	-	**0**
Isle au Haut Stream Site #5 (1.6)	-	-	-	1	-	-	-	-	**1**
Lurvey Brook (0.5)	-	-	-	5	-	-	1	2	**2**
Richardson's Brook Site #1 (0.7)	20	2	-	-	-	-	-	-	**1**
Richardson's Brook Site #2 (0.7)	8	-	-	2	-	1	-	-	**3**
Total	**37**	**7**	**1**	**15**	**3**	**2**	**2**	**2**	**5**
IA[2]	**2.8**	**0.5**	**0.1**	**1.1**	**0.2**	**0.2**	**0.2**	**0.2**	

[1]Does not include Ranid spp. observations
[2]Based on 13.1 total person hours

Table 10. Number of amphibians recorded in three stream zones during stream time-constrained surveys at 10 sites in Acadia National Park, 11 May to 13 August 2001. The stream zone included the area with flowing water; the splash zone encompassed the area from the edge of the water to the bank, and the bank zone extended three meters from the edge of the splash zone onto the bank.

Species	Stream Zone	Splash Zone	Bank Zone	Total
Northern Two-lined Salamander	13	31	1	**45**
Eastern Red-backed Salamander	1	6	8	**15**
Pickerel Frog	2	1	0	**3**
Eastern Newt	1	1	0	**2**
Green Frog	1	1	0	**2**
Ranid spp.	0	0	2	**2**
Total	**18**	**40**	**11**	**69**

Table 11. Number of amphibians recorded in five substrate types during stream time-constrained surveys at 10 sites in Acadia National Park, 11 May to 13 August 2001.

Species	Boulder	Cobble	Gravel	Leaf	Log	Other	Total
Northern Two-lined Salamander	7	34	3	0	1	0	**45**
Eastern Red-backed Salamander	3	6	0	1	5	0	**15**
Pickerel Frog	1	1	1	0	0	0	**3**
Eastern Newt	0	1	1	0	0	0	**2**
Green Frog	0	0	0	0	0	2	**2**
Ranid spp.	0	0	0	0	0	2	**2**
Total	**11**	**42**	**5**	**1**	**6**	**4**	**69**

Woodland/Field TCS

Seven species were detected during woodland/field TCS at nine sites. The eastern red-backed salamander was the most widespread species, recorded at six of nine (67%) sites surveyed, followed by common garter snake (33% of sites), northern green frog (22%), and northern two-lined salamander, American toad, pickerel frog, and northern red-bellied snake (11% of sites) (Table 12). The red-backed salamander was also the most abundant species, with an Index of Abundance of 2.8 individuals/search hour, and the northern two-lined salamander, American toad, pickerel frog, and northern red-bellied snake were least abundant (IA=0.1 for each) (Table 12). Seal Cove Road Woods and South Tarn Trail had the greatest species richness with three species recorded at each site. Of the two field sites, no animals were recorded from Carroll Homestead, and Sargent Drive Picnic Area produced two species, both of which were also found in woodland sites (Table 12).

Table 12. Number of amphibians and reptiles recorded during woodland/field time-constrained surveys at nine sites in Acadia National Park, 17 May to 29 August 2001. Index of Abundance (IA) is number of individuals divided by total search effort described in Appendix 4.

Site (search hrs)	Species							Total Inds.	Total Spp.
	Red-backed Salamander	Common Garter Snake	Northern Green Frog	Northern Two-Lined Salamander	American Toad	Pickerel Frog	Northern Red-bellied Snake		
Carroll Homestead* (1.0)	-	-	-	-	-	-	-	**0**	**0**
Jordan Pond Trail North (0.6)	-	1	-	-	-	1	-	**2**	**2**
Long Pond Trail (2.2)	-	1	-	-	-	-	-	**1**	**1**
Sargent Drive Picnic Area *(2.2)	2	2	-	-	-	-	-	**4**	**2**
Seal Cove Rd. Woods (0.7)	4	-	1	1	-	-	-	**6**	**3**
Seal Cove Rd. Woods-west (1.8)	16	-	-	-	-	-	-	**16**	**1**
South Tarn Trail (1.7)	2	-	1	-	-	-	1	**4**	**3**
Western Mt. Rd. Woods (1.8)	8	-	-	-	-	-	-	**8**	**1**
Western Trail (0.6)	3	-	-	-	1	-	-	**4**	**2**
Total	**35**	**4**	**2**	**1**	**1**	**1**	**1**	**45**	**7**
IA[1]	**2.8**	**0.3**	**0.2**	**0.1**	**0.1**	**0.1**	**0.1**		

[1]Based on 12.6 total person hours, *field habitat

Wetland/Pond TCS

Nine species were detected during wetland/pond TCS at 20 sites. The northern green frog and pickerel frog were the most widespread species, recorded at 13 of 20 (65%) sites surveyed, followed by American bullfrog (40% of sites), spotted salamander (20%), eastern red-backed salamander, common garter snake, and red-spotted newt (15%), spring peeper (10%), and northern red-bellied snake (5% of sites) (Table 13). The northern green frog was the most abundant species, with an Index of Abundance of 4.1 adults/search hour. A few other species (i.e. pickerel frog, American Bullfrog and spotted salamander) were nearly as abundant, with IA of 3.8. 2.3, and 1.9, respectively, and the red-spotted newt, spring peeper, and northern red-bellied snake were least abundant (IA=<0.1) (Table 13). Heath Brook Wetland and Western Mountain Road Wetland had the greatest species richness with four species, and no species were recorded at Long Pond Fire Road Wetland (Table 13).

Table 13. Number of amphibians and reptiles recorded during wetland/pond time-constrained surveys at 20 sites in Acadia National Park, 2 May to 4 September 2001. Index of Abundance (IA) is number of individuals divided by total search effort described in Appendix 4.

Site (search hrs)	Species														Total # species[1]
	Northern Green Frog		Pickerel Frog	Spotted Salamander	Ranid spp.		American Bullfrog		Eastern Red-backed Salamander	Common Garter Snake	Red-spotted Newt		Spring Peeper	Northern Red-bellied Snake	
	Adult	Larvae	Adult	Egg Mass	Adult	Larvae	Adult	Larvae	Adult	Adult	Adult	Eft	Adult	Adult	
Duck Pond (2.9)	36	-	3	82	24	-	-	-	-	-	-	-	-	-	**3**
Dudley Pond (0.3)	9	-	8	-	-	-	-	-	-	-	1	-	-	-	**3**
Eagle Lake SE Marsh (1.4)	15	-	23	3	24	-	-	-	-	-	-	-	-	-	**3**
Echo Lake Wetland (2.8)	-	-	1	-	-	-	-	-	1	-	-	-	-	-	**2**
Gilmore Meadow (2.8)	17	-	10	-	7	-	7	-	-	-	-	-	-	-	**3**
Great Meadow (3.4)	1	-	-	2	-	-	-	-	-	2	-	-	-	-	**3**
Half Moon Pond (1.2)	6	-	9	-	1	2	23	5	-	-	-	-	-	-	**3**
Heath Brook Wetland (1.6)	17	1	30	15	-	8	-	-	-	-	-	1	-	-	**4**
Hodgdon Pond/Field (2.0)	-	-	-	-	9	-	19	-	-	-	-	-	-	-	**1**
Jordan Stream Wetland (0.8)	10	-	-	-	2	-	2	1	-	-	-	-	-	-	**2**
Long Pond Fire Rd. Wetland (0.3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**0**
Long Pond Fire Road (1.1)	-	-	-	-	-	-	-	-	2	-	-	-	-	-	**1**
North Jordan Pond Beaver Wetland (0.6)	4	-	-	-	3	1	1	-	-	1	-	-	-	-	**3**
Sand Beach Field/Marsh (4.6)	-	3	-	-	-	-	-	-	-	1	-	-	-	-	**2**
Schooner Head Wetland (1.2)	9	6	17	-	6	-	-	-	-	-	-	-	-	-	**2**
Seal Cove Pond NE Shore (0.7)	-	-	16	-	-	-	5	-	1	-	-	-	-	-	**3**

Table 13. Number of amphibians and reptiles recorded during wetland/pond time-constrained surveys at 20 sites in Acadia National Park, 2 May to 4 September 2001. Index of Abundance (IA) is number of individuals divided by total search effort described in Appendix 4. (continued).

Site (search hrs)	Species														Total # of Spp[1]
	Northern Green Frog		Pickerel Frog	Spotted Salamander	Ranid spp.		American Bullfrog		Eastern Red-backed Salamander	Common Garter Snake	Red-spotted Newt		Spring Peeper	Northern Red-bellied Snake	
	Adult	Larvae	Adult	Egg Mass	Adult	Larvae	Adult	Larvae	Adult	Adult	Adult	Eft	Adult	Adult	
Seal Cove Pond South Marsh (1.0)	-	-	3	-	-	-	6	-	-	-	-	-	1	-	**3**
Two Moose Pond (1.3)	3	-	3	-	1	-	-	-	-	-	-	-	-	-	**2**
Western Mt. Rd. Wetland (2.2)	-	-	2	-	-	-	-	-	-	-	-	1	1	1	**4**
Witch Hole Pond (2.1)	12	-	6	-	4	-	17	-	-	-	-	-	-	-	**3**
Total	**139**	**10**	**131**	**102[3]**	**81**	**11**	**80**	**6**	**4**	**4**	**1**	**2**	**2**	**1**	**9**
IA[2]	**4.1**	**0.3**	**3.8**	**3.0[3]**	**2.4**	**0.3**	**2.3**	**0.2**	**0.1**	**0.1**	**<0.1**	**<0.1**	**<0.1**	**<0.1**	

[1]does not include Ranid spp. observations
[2]Based on 34.3 total person hours
[3] These represent 65 adult females and give an IA of 1.9 adults/search hour

Coverboards

Sixty-two snakes of five species were captured under 29 (21%) coverboards at 19 sites (Table 14). The common garter snake was the most widespread species, recorded at 53% (10/19) of coverboard sites, followed by northern red-bellied snake (32%, 6/19), smooth green snake (16%, 3/19), and northern ring-necked snake and eastern milk snake (*Lampropeltis t. triangulum*) (5%, 1/19) of sites (Table 14). Although the common garter snake was most widespread, based on numbers and capture rate (CR), the northern red-bellied snake was most abundant (n=28 individuals, CR=3.0), followed by common garter snake (n=24, CR=2.6) and smooth green snake (n=8, CR=0.9). The northern ring-necked snake and eastern milk snake were least abundant (n=1, CR=0.1) (Table 14). Both abundance and species richness were greatest at Seal Cove Road Homestead Field, with 17 snakes of four species captured (Table 14). Kebo Street Field was the only survey site on Mount Desert Island where no snakes were captured. Only one snake, a northern ring-necked snake at Old Gravel Pit, was captured under boards deployed at seven sites on Isle au Haut (Table 14).

Table 14. Number of snakes recorded during coverboard surveys at 19 sites in Acadia National Park, 8 May to 23 September 2001. Capture Rate (CR) is number of snakes captured/100 board checks. Board checks are number of boards per site, multiplied by number of visits.

Site	Number of Snakes								# of Boards per Site	# of Site Visits	# of Board Checks	# Boards with Snakes
	Northern Red-bellied Snake	Common Garter Snake	Smooth Green Snake	Northern Ring-necked Snake	Eastern Milk Snake	# Snakes	# Spp.	CR				
Bar Island Field	-	1	-	-	-	1	1	1.4	12	6	72	1
Beech Hill Rd Field	6	4	-	-	-	10	2	17.9	8	7	56	5
Blackwoods Field	-	1	-	-	-	1	1	1.8	8	7	56	1
Cadillac Mountain Field	-	3	1	-	-	4	2	3.6	16	7	112	2
Fernald Point Field	-	1	-	-	-	1	1	0.8	16	8	126[1]	1
Hodgdon Pond Field	5	2	-	-	-	7	2	10.9	8	8	64	5
IAH-Merchants Cove	-	-	-	-	-	-	0	0.0	2	3	6	-
IAH-Old Campground Field	-	-	-	-	-	-	0	0.0	2	3	6	-
IAH-Old Cemetery	-	-	-	-	-	-	0	0.0	1	2	2	-
IAH-Old Gravel Pit	-	-	-	1	-	1	1	33.3	1	3	3	1
IAH-Shark Point Beach Field	-	-	-	-	-	-	0	0.0	2	3	6	-
IAH-Shark Point South Field	-	-	-	-	-	-	0	0.0	1	3	3	-
IAH-Western Head Field	-	-	-	-	-	-	0	0.0	2	3	6	-
Kebo Street Field	-	-	-	-	-	-	0	0.0	12	8	72[2]	-
Mars Field	5	-	1	-	-	6	2	7.1	12	7	84	3
Sand Beach Field Back	-	4	-	-	-	4	1	6.3	8	8	64	2
Sand Beach House Field Front	2	1	-	-	-	3	2	5.4	8	7	56	2
Seal Cove Road Site 1 Field	6	1	-	-	-	7	2	9.2	10	8	76[3]	4
Seal Cove Road Homestead Field	4	6	6	-	1	17	4	26.6	8	8	64	2
Total	**28**	**24**	**8**	**1**	**1**	**62**	**5**	**6.6**	**137**	**109**	**934**	**29**
CR	**3.0**	**2.6**	**0.9**	**0.1**	**0.1**							

[1]One visit had only 14 coverboard checks. [2]All 12 boards were only checked on 3 days.
[3]Two wood coverboards were not checked during the first 2 site checks.

The majority of coverboard checks occurred during August and September (61%), but most (69%) snakes observed under coverboards were recorded during April-July (Table 15). These seasonal differences in numbers captured (43 vs. 19 snakes) were significant (χ^2=24.5, p<0.01). Also, captures were significantly higher under metal (76%) versus wood (24%) coverboards (χ^2=12.7, p<=0.01, Table 16).

Table 15. Seasonal variation in snake captures during coverboard surveys in Acadia National Park, April to July versus August to September 2001. Board checks are the number of boards per site, multiplied by the number of site visits.

Dates	Number (%) of Board Checks	Number of Board Checks Producing Snakes	Percent of Board Checks Producing Snakes	Number (%) of Snakes
April – July	365 (39%)	30	8.2%	43 (69%)
August – September	569 (61%)	18	3.2%	19 (31%)
Total	**934**	**48**	**5.1%**	**62**

Table 16. Number of snakes captured under metal versus plywood during coverboard surveys in Acadia National Park, 8 May to 23 September 2001.

Species	Total Number of Snakes	Coverboard Type			
		Metal[1]		Plywood[1]	
		# of Snakes	% of Snakes	# of Snakes	% of Snakes
Northern Red-bellied Snake	28	19	68%	9	32%
Common Garter Snake	24	19	79%	5	21%
Smooth Green Snake	8	7	88%	1	12%
Eastern Milk Snake	1	1	100%	0	0%
Northern Ring-necked Snake	1	1	100%	0	0%
All snakes	**62**	**47**	**76%**	**15**	**24%**

[1]Total of 73 metal and 64 plywood coverboards, representing 53% and 47 % respectively.

The total number of snakes captured during this inventory (coverboards, TCS, and incidental encounters combined) were: Common Garter Snake (43); Northern Red-bellied Snake (33); Smooth Green Snake (23); Eastern Milk Snake (2); and Northern Ring-necked Snake (2). Among those measured, the longest species was Eastern Milk Snake (max SVL=602 mm, mean (± SD) SVL =602 ± 0 mm, n=1), followed by Common Garter Snake (max SVL=600 mm, mean SVL=343 ± 119 mm, n=31), Smooth Green Snake (max SVL= 390 mm, mean SVL=241 ± 77 mm, n=23), Northern Red-bellied Snake (max SVL=240 mm, mean SVL=196 ± 31 mm, n=24) and Northern Ring-necked Snake (max SVL=264, mean SVL=247 ± 25 mm, n=2)) (Fig. 5, Appendix 9).

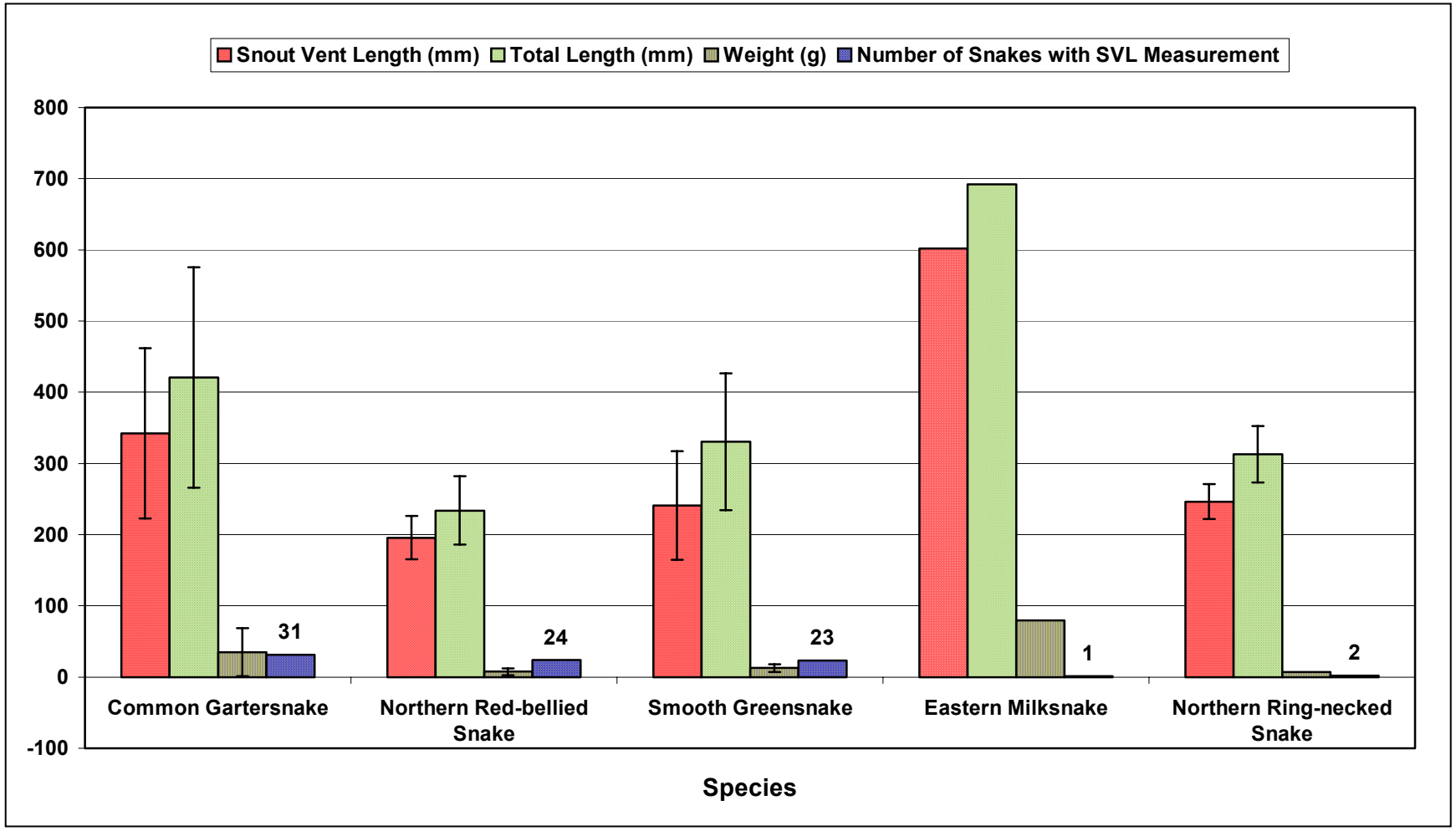


Figure 5. Average measurements of snakes captured in Acadia National Park, 11 May to 20 September 2001 during coverboard surveys, time-constrained surveys, and as incidental encounters. Total number of snakes captured are: Common Garter Snake (43); Northern Red-bellied Snake (33); Smooth Green Snake (23); Eastern Milk Snake (2); and Northern Ring-necked Snake (2). Bars represent standard deviation.

Turtle Traps

We trapped 101 individual turtles of two species at 11 sites. Sixty-one painted turtles were captured at eight of 11 sites (73% of sites sampled) and 40 snapping turtles were captured at nine sites (82% of sites) (Table 17). While no turtles were captured at Isle au Haut Long Pond and Eagle Lake on Mount Desert Island, trapping effort at these sites was extremely limited, only four and nine trap nights, respectively. Painted turtles were most abundant at Little Turtle Pond, with an estimated population size (N) of 76 ± 59.6 individuals, followed by North Breakneck Pond (N=15±6.8), Fawn Pond (N=14±10.7), Northeast Creek (N=11± 9.6) and Beaver Dam "Muck Pond" (N=11±11.8). Trapping at Northeast Creek yielded the most snapping turtles (10 individuals). Snapping turtle abundance was greatest at Fawn Pond based on Index of Abundance (IA=10.3 inds/trap night), but estimated population size was greatest at Geronimo Pond (N=20 ± 22.0) (Table 17).

Table 17. Number of turtles captured during turtle trapping at 11 sites in Acadia National Park, 23 April to 29 June 2001. Number of trap nights is number of traps deployed multiplied by number of nights traps were set. # New= number of new captures; Index of Abundance (IA) is number of individuals captured per 100 trap nights; # Recap=number of recaptures; N=estimated number of turtles based on Chapman's modified Lincoln Petersen Index; 95% CI= lower and upper limits of 95% confidence interval.

Site	# of Trap Nights	Painted Turtles						Snapping Turtles					
		# New	IA	# Recap	N	95% CI		# New	IA	# Recap	N	95% CI	
Beaver Dam "Muck Pond"	121	4	3.3	0	11	-0.8	22.8	3	2.5	1	2	2.0	2.0
Duck Pond	105	2	1.9	0	2	2.0	2.0	1	1.0	0	1	1.0	1.0
Eagle Lake Pond	9	0	0.0	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0
Fawn Pond	87	9	10.3	1	14	3.3	24.7	9	10.3	3	7	4.8	8.2
Geronimo Pond	155	3	1.9	0	5	0.2	9.8	8	5.2	0	20	-2.0	42.0
Isle au Haut Long Pond	4	0	0.0	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0
Little Turtle Pond	127	16	12.6	3	76	16.4	135.6	1	0.8	0	1	1.0	1.0
MDI Long Pond	32	0	0.0	0	0	0.0	0.0	2	6.3	1	3	0.2	5.8
North Breakneck Pond	158	12	7.6	5	15	8.2	21.8	5	3.2	1	11	-0.8	22.8
Northeast Creek	183	11	6.0	3	11	6.2	15.8	10	5.5	5	11	5.1	16.9
Upper Hadlock Pond	176	4	2.3	0	7	0.2	13.8	1	0.6	0	1	1.0	1
Total	**1157**	**61**	**5.3**	**12**	**141**	**39.5**	**242.5**	**40**	**3.5**	**11**	**57**	**27.5**	**85.5**

Carapace length (Mean ± SD) of female painted turtles (CL=146.7 ± 29.1, n=46) was longer than that of males (CL=133.6 ± 17.4, n=36) (Fig. 6, Appendix 10). Conversely, the carapace length (Mean ± SD) of male snapping turtles was longer (CL=280.6 ± 52.9, n=32) than that of female snapping turtles (CL=236.6 ± 78.5, n=11) (Fig. 7, Appendix 11).

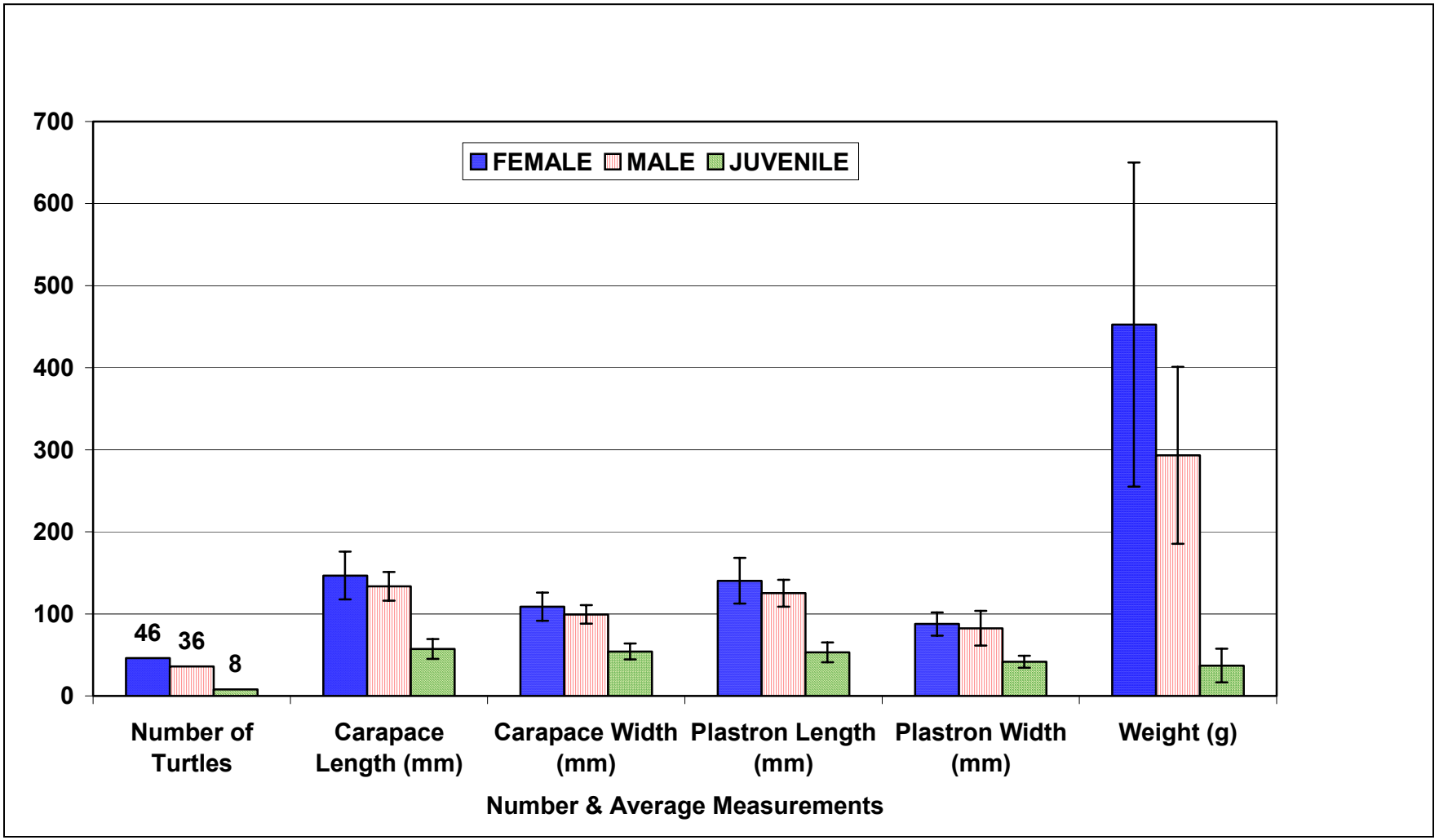


Figure 6. Average measurements and total number of Painted Turtles captured in Acadia National Park in 2001. Bars represent standard deviation.

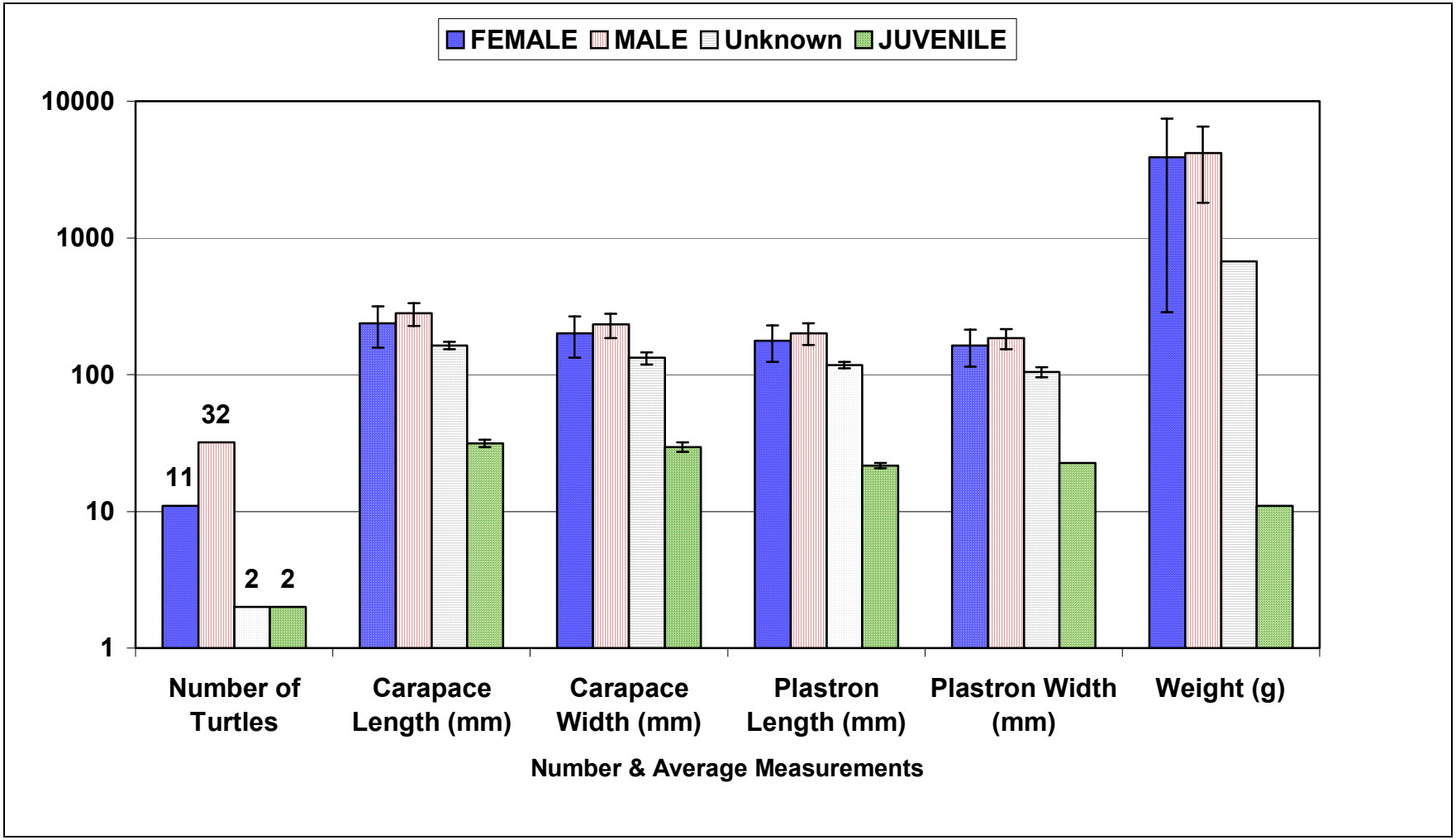


Figure 7. Average measurements and total number of Snapping Turtles captured in Acadia National Park in 2001. Bars represent the standard deviation.

Minnow Traps

We detected eight species using minnow traps. The northern green frog was the most widespread, recorded at nine of 12 (75%) minnow trap sites, followed by American bullfrog and spotted salamander (50% of sites), red-spotted newt (42%), spring peeper (33%), wood frog (17%), and pickerel frog and painted turtle (8% of sites). Northern green frog was the most abundant larval form captured in minnow traps (IA=28.2), though American bullfrog (IA=18.4) and wood frog (IA=8.9) were also common. At the two sites where wood frog larvae were recorded, it was the most abundant amphibian larvae (Table 18). Spotted salamander was the most abundant adult (IA=8.4), with red-spotted newt almost as abundant (IA=5.6). Minnow traps were not effective in capturing adult anurans. Species richness was greatest at Schooner Head Wetland with seven species recorded, while only one species, a single adult spotted salamander, was captured on Isle au Haut, and no animals were captured at Seawall Pond (Table 18).

Table 18. Number of amphibians and reptiles captured during minnow trapping at 12 sites in Acadia National Park, 17 April to 29 June 2001. Number of trap nights is number of traps multiplied by number of nights traps were set. Life stage of animals captured is: A=Adult; J=Juvenile; L=Larvae; and E=Egg mass. Index of Abundance (IA) is number of individuals captured per 100 trap nights.

Site	#Trap Nights	Species																										# of Spp
		Northern Green Frog				American Bullfrog				Spotted Salamander						Red-spotted Newt		Spring Peeper				Wood Frog		Pickerel Frog		Painted Turtle		
		A	IA	L	IA	A	IA	L	IA	A	IA	L	IA	E	IA	A	IA	A	IA	L	IA	L	IA	A	IA	J	IA	
Big Heath Pond	19	-	-	10	52.6	-	-	-	-	26	136.8	-	-	2	10.5	-	-	-	-	-	-	-	-	-	-	-	-	**2**
Duck Pond	62	2	3.2	68	109.7	-	-	9[1]	14.5	-	-	-	-	-	-	7	11.3	-	-	1	1.6	-	-	-	-	-	-	**4**
Fawn Pond	22	-	-	4	18.2	-	-	17	77.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2**
Geronimo Pond	18	-	-	1	5.6	-	-	15	83.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2**
Heath Brook Wetland	15	1	6.7	1	6.7	-	-	-	-	-	-	3	20.0	-	-	-	-	-	-	2	13.3	-	-	-	-	-	-	**3**
Isle au Haut Pond Site1	4	-	-	-	-	-	-	-	-	1	25.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**
Little Turtle Pond	33	-	-	17	25.8	1	3.0	8	24.2	-	-	-	-	-	-	2	6.1	-	-	-	-	-	-	-	-	-	-	**3**
New Mill Meadow	21	-	-	12	57.1	-	-	-	-	-	-	1	4.8	-	-	1	4.8	-	-	-	-	14	66.7	-	-	-	-	**4**
North Breakneck Pond	66	-	-	2	3.0	-	-	29	43.9	-	-	-	-	-	-	3	4.5	-	-	-	-	-	-	-	-	1	1.5	**4**
Schooner Head Wetland	76	2	2.6	12	15.8	-	-	5	6.6	-	-	4	5.3	-	-	12	15.8	-	-	2	2.6	26	34.2	1	1.3	-	-	**7**
Seawall Pond	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**0**
Sunken Heath	105	-	-	-	-	-	-	-	-	11	10.5	-	-	5	4.8	-	-	3	2.9	-	-	-	-	-	-	-	-	**2**
Total	**450**	**5**	**1.1**	**127**	**28.2**	**1**	**0.2**	**83**	**18.4**	**38**	**8.4**	**8**	**1.8**	**7**	**1.6**	**25**	**5.6**	**3**	**0.7**	**5**	**1.1**	**40**	**8.9**	**1**	**0.2**	**1**	**0.2**	

[1]Individuals were seen on only one occasion, these were possibly confused with Green Frog

Drift Fencing

Four species were captured in drift fence traps at Sunken Heath, the only site where we used this method. The spring peeper was the most abundant species captured (IA=2.3 inds/100 trap nights), followed by the spotted salamander (IA=1.0), pickerel frog and northern red-bellied snake (IA=0.1) (Table 19). Even though Sunken Heath appeared to have appropriate habitat for four-toed salamanders, none were captured.

Table 19. Number of amphibians and reptiles captured in drift-fence pitfall and funnel traps at Sunken Heath in Acadia National Park, 12 April to 21 May2001. Number of trap nights is number of traps installed with the drift fence multiplied by number of nights the traps were set. Index of Abundance (IA) is number of individuals captured per 100 trap nights. Total trapping effort was 1,323 trap nights.

Species	**Sex**			**Total**	**IA**
	Male	**Female**	**Unknown**		
Spring Peeper	0	1	29	**30**	**2.3**
Spotted Salamander	9	4	0	**13**	**1.0**
Pickerel Frog	0	0	1	**1**	**0.1**
Northern Red-bellied Snake	0	0	1	**1**	**0.1**
All Species	**9**	**5**	**31**	**45**	**3.4**

Incidental Encounters

We detected eighteen species as a result of incidental encounters at 226 locations. Of these, 65 locations were also standardized survey sites of some kind. Based on the number of locations recorded, the most widespread (and generally most frequently encountered) species were common garter snake, spotted salamander spring peeper and northern green frog (Table 20). Based on numbers of adult form individuals represented, the most abundant species encountered were spring peeper (18% of individuals), spotted salamander (17%), northern green frog (16%), and American bullfrog (15%), and the least abundant species were American toad (0.3%), northern ring-neck snake (0.2%), and northern two-lined salamander (0.1%, Table 20). One gray treefrog (*Hyla versicolor*) was reported calling near Hodgdon Pond, however, the report is of uncertain accuracy and is not considered confirmed. Four-toed salamanders were only found during incidental encounters in sphagnum-moss habitats and on roads in the vicinity of or bisecting, appropriate habitat.

Table 20. Number of amphibians and reptiles recorded as incidental encounters at 226 locations in Acadia National Park, 2 April to 15 October 2001. Life stage or evidence of presence is: ADL=adult; KLL=kill; SHD=shed; JUV=juvenile; LAR=larvae; UK=unknown; VOC=anuran vocalization; EGG=egg masses. (#E)=number of times a species was encountered; (#L)=number of larvae counted; (#M)=estimated number of males calling; (#F)=estimated number of adult females. Total Adult is total of all adult form individuals, plus estimated numbers of adults represented by egg masses and vocalizations.

Species	# of Locations	# of Individuals by Life Stage/Evidence of Presence												
		Total Adult	% of Total	ADL	KLL	SHD	JUV	LRV		UK	VOC		EGG	
								#E	#L		#E	#M	#E	#F
Common Garter Snake	**85**	106	5%	55	9	-	5	-	-	37	-	-	-	-
Spotted Salamander	**50**	361	17%	33	2	-	-	-	-	2	-	-	38	324
Spring Peeper	**44**	380	18%	10	-	-	-	-	-	-	66	370	-	-
Northern Green Frog	**38**	334	16%	165	1	-	24	3	32	-	32	136	2	8
Painted Turtle	**28**	228	11%	68	2	-	2	-	-	156	-	-	-	-
Eastern Red-backed Salamander	**25**	85	4%	84	1	-	-	-	-	-	-	-	-	-
Pickerel Frog	**26**	118	5%	79	1	-	-	-	-	-	12	34	4	4
Smooth Green Snake	**37**	39	2%	33	5	-	1	-	-	-	-	-	-	-
Snapping Turtle	**27**	46	2%	25	3	-	6	-	-	12	-	-	-	-
American Bullfrog	**20**	321	15%	263	1	-	1	8	179	-	22	56	-	-
Wood Frog	**20**	34	2%	9	-	-	-	2	101	-	14	24	1	1
Ranid Species	**12**	5	<1%	3	-	-	-	6	16	1	1	1	-	-
Northern Red-bellied Snake	**11**	12	1%	4	2	-	-	-	-	6	-	-	-	-
Eastern Milk Snake	**10**	10	<1%	7	2	1	-	-	-	-	-	-	-	-
Red-spotted Newt	**10**	22	1%	11	1	-	9	-	-	1	-	-	-	-
Four-toed Salamander	**9**	29	1%	20	-	-	-	-	-	2	-	-	3	7
Northern Ring-necked Snake	**4**	4	<1%	-	1	-	1	-	-	2	-	-	-	-
American Toad	**3**	6	<1%	3	-	-	-	-	-	1	1	2	-	-
Northern Two-lined Salamander	**2**	3	<1%	2	-	-	1	-	-	-	-	-	-	-
Species Unknown	**2**	4	<1%	1	-	-	-	-	-	3	-	-	-	-
Gray Treefrog[1]	**1**	-	-	-	-	-	-	-	-	-	1	NA	-	-
Total Individuals		**2147**	**-**	**875**	**31**	**1**	**50**	**19**	**328**	**223**	**149**	**623**	**48**	**344**

[1]Unconfirmed report

Discussion

Community Composition and Species Richness

Of the 36 species of amphibians and reptiles documented on Maine's mainland (Hunter et al. 1999), 18 were recorded at Acadia National Park during this inventory. These represent 82% of the species believed to historically occur there. Reasons for the small number of amphibian and reptile species found at Acadia are a combination of regional and local factors. The herpetofauna of Maine is fairly depauperate, ranking 46th of 50 among the United States (Moriarty 2004). This reflects Maine's northerly latitude. Species richness of North American herpetofauna declines with increasing latitude (Porter 1972). Further north, the average number of species in Canadian provinces is 17, with an average of 10 amphibian and 7 reptile species (Moriarty 2004). In addition to species richness being low in northern locales, northern herpetofaunal communities tend to be dominated by amphibians. At Acadia, amphibians dominated in terms of species richness (61% of species) and in numbers (88% of individuals). The dominance of northern herpetofaunas such as Acadia's (and Canada's) by amphibians is due to the fact that amphibians generally have lower activity temperature requirements than reptiles (Zug 1993).

While Acadia occurs within a region of low herpetofaunal species richness, other factors contribute further to its low species richness. Some species found in Maine do not range as far north as Acadia. Moreover, the insular nature of Acadia has likely limited the number of species there. In the northeast, amphibians and reptiles advancing north following the retreat of the Pleistocene glaciers had to colonize sites that would become islands prior to their being isolated by sea level rise (Lazell and Michener 1976). Afterwards, colonization would have to occur across a salt-water barrier. Presumably, some of the species that presently occur along the coast of Maine arrived after Mount Desert Island and Isle au Haut were isolated, and are unable to colonize. Finally, relatively small, offshore islands tend to have less habitat diversity than the adjacent mainland, with correspondingly fewer species able to find appropriate habitat. The differences between Isle au Haut, with 10 species recorded and Mount Desert Island, with 18 species, illustrate these effects. Compared to Mount Desert Island, Isle au Haut is both smaller and further out into the Atlantic, where rising sea level would have isolated it from the mainland earlier.

Species at Risk

The 18 species of amphibians and reptiles documented at Acadia are mostly species that are common to the northeast (Klemens 1993; Conant and Collins 1998) and are representatives of species that are even more widespread. Many are at or close to the northern limit of their distributions. From a preservation of species at risk perspective, Acadia does not support any species that are exceptionally rare, such that it could be considered a critical site for a rare or declining species. The only species present that is listed by the State of Maine is the four-toed salamander (*Species of Special Concern*). The four-toed salamander is a habitat specialist (*Sphagnum*-dominated wetlands and vernal ponds) difficult to detect and its true abundance is likely underestimated, both at Acadia and throughout much of its range. Thus,

Acadia is not currently a significant refuge for locally rare and endangered amphibian and reptile species. However, this may change in time as Maine experiences coastal development and urban-suburban populations expand.

Ecological Function

Amphibians and reptiles are important in ecosystem functions, particularly energy flow between trophic levels. In general, they occupy the middle region of the food chain (Zug 1993). Moreover, many species of amphibians and reptiles achieve such densities that they dominate the vertebrate biomass in their respective ecosystems and can influence the structure and composition of plant and invertebrate communities (Burton and Likens 1975; Congdon et al. 1986; Congdon and Gibbons 1989; Gibbons 1988; Pechmann et al. 1989). Thus, even though composed of relatively common species, the herpetofauna of Acadia is important in trophic dynamics, consuming insects, invertebrates, and small vertebrates, serving as prey for larger vertebrates, and contributing to the overall integrity of the ecosystems in which they occur.

Given that amphibians dominate the herpetofauna of Acadia, the importance of wetland habitats is hardly surprising. Wetlands had the greatest species richness as well as the majority of individuals recorded (Table 1). With the exception of the eastern red-backed salamander, all of the amphibians at Acadia depend on some type of wetland or stream habitat for reproduction. Yet, half of the amphibian species at Acadia are otherwise primarily terrestrial or fossorial. Spring peeper, wood frog, American toad, spotted salamander, and four-toed salamanders all depart from wetland habitats following the breeding season, foraging and hibernating in the uplands. Thus, in this inventory, sphagnum bogs, deep open water ponds, vernal pools, streams and seeps, grass fields, woodlands, and roadsides were all found to be important habitats for amphibians and reptiles. As a consequence, the role of amphibians and reptiles in food webs extends far beyond wetlands and, while wetland protection is critical to their maintenance, the complex habitat needs of many species make protection in terrestrial habitats equally important. This includes not only protection from vehicle mortality (discussed below), but also recognizing such needs as aquatic turtles requiring open, sparsely vegetated upland habitats for nesting.

Roads

In the northeast, several species of salamanders migrate to breeding ponds in the spring (Petranka 1998), frequently crossing roads in large numbers on rainy nights. In Acadia, spotted salamanders and four-toed salamanders were found crossing roads (e.g. Route 233, Route 102, the park loop road at Great Meadow, Indian Point Road, and Duck Brook Road) in April and May. Painted and snapping turtles were encountered crossing roads in search of nesting sites in June. Many utilize carriage roads and roadsides as the only available open habitats. Based upon our observations, and those of park staff, turtles frequently are seen moving between Little Turtle Pond and the north end of Eagle Lake and crossing Route 233 (Connery, pers. comm.). Vehicle traffic can cause significant amphibian and reptile mortality in populations whose habitat is bisected by roads (Fahrig et al. 1995; Gibbs and Shriver 2002). In this survey, 17 of the 18 species detected were recorded on roads. While

road kill does not appear to be a critical problem at Acadia, it is one of several stressors that are acting in concert on the park's herpetofauna. Steps to reduce it should be taken where possible. Sections of road where numbers of migrating amphibians and reptiles are known to cross should be monitored to assess road-kill. Temporary closure of these roads during peak breeding and nesting seasons (especially on rainy nights) are recommended to minimize road mortality. Road sections where amphibian and reptile mortality occur should be evaluated for elevating above grade or installation of wildlife friendly road tunnels and leaders to provide safe travel routes for migrating animals in heavy traffic areas (Jackson 1996; U.S DOT-FHA Critter Crossings), particularly when these can be incorporated into road rehabilitation and reconstruction projects.

Population Trends

In the species accounts (below), we have attempted to assess each species' status and population trends. This is a somewhat subjective process, comparing our data with the limited historical data available (Coman 1987; Davis 1958; Manville 1938, 1939). The historical data itself is subjective and qualitative at best. Descriptive terms of abundance are not defined nor is there much information on amount of sampling effort. Thus, a quantitative comparison is not possible, and we are left to make the best use of what information is available. In spite of these limitations, it appears that for most of Acadia's herpetofauna, abundance has not changed much. As detailed in the species accounts below, of the 22 species believed to have occurred historically, 16 appear to be relatively unchanged, one (painted turtle) has increased, one (American toad) has declined, and two (dusky salamander, northern leopard frog) appear to be extirpated or nearly so. The last two (grey treefrog, musk turtle) are undetermined. While they were not recorded in this survey, they appear to always have been rare at Acadia.

While most of Acadia's amphibian and reptile species appear to be maintaining themselves, there is evidence to suggest the herpetofauna of Acadia is in decline. American toads appear to be less common, leopard frogs appear extirpated, and dusky salamanders appear nearly extirpated. While determining the cause(s) of these declines is beyond the scope of this inventory, they are likely the result of a combination of the same factors believed to be responsible for amphibian declines worldwide. These include high concentrations of metals, chemicals found in fertilizers, herbicides, and pesticides, acid rain, exposure to increased levels of ultraviolet-B radiation, habitat degradation, disease, road mortality, and introduced species (Dunson et al. 1992; Blaustein 1994; Blaustein et al. 1994; Pechman and Wilbur 1994; Hunter et al. 1999; Daszak et al. 2000; Knapp and Matthews 2000). Several of these factors have been documented at Acadia.

Stressors

Acid precipitation is prevalent throughout the northeast and may have contributed to the apparent extirpation of leopard frogs, a species whose eggs and larvae are intolerant of acidic conditions (Pierce 1985). Atmospheric deposition of mercury also occurs at Acadia, with high levels of mercury present in stream habitats and the stream-dwelling two-lined salamanders (Bank 2003, Bank et al., in press). This suggests a possible role for mercury in

the disappearance of Acadia's other species of stream salamander, the northern dusky salamander. In addition, there have been recent episodic die-offs of spotted salamanders, spring peepers, wood frogs and green frogs. Research at Acadia suggests that a fungus, iridovirus, and/or protozoans may have played a role in these die-offs (Daszak et al. 2000; Green and Converse 2000; Dougherty 2003; Connery, pers. comm.). However, research also suggests that while disease agents may be the proximate cause of these die-offs, they occur in populations stressed by pollutants and habitat degradation that leaves them susceptible to disease. Thus it would appear that there is a whole suite of stressors, particularly various pollutants and disease agents that are acting in concert both directly and indirectly to reduce or eliminate the park's most sensitive species. Additional research is needed to better determine the extent and ways in which these factors affect the park's amphibians.

Survey Methods

The experience in this survey parallels aspects of other inventories in that incidental encounter documented more species and individuals than any other method. Campbell and Christman (1982) detected 60 species using a combination of nocturnal road cruising (38 species), quadrat samples (15 species), drift fence arrays (29 species) and time-constrained search (24 species) in Florida. An additional 25 species were detected through opportunistic collecting. At Gulf Islands National Seashore, Siegel and Doody (1996) report that general collecting (i.e. search under cover object, nighttime road surveys, and seining, and time-constrained search) was by far the most effective technique for detecting species and numbers of individuals, among methods that also included drift fences, minnow traps, aquatic turtle traps, coverboards, and automated anuran call counts. While there is a degree of fuzziness in these comparisons in that incidental encounter, opportunistic collecting, and general herpetological collecting are defined differently, these results illustrate two points. First, when it comes to merely detecting species presence, formal, trap or equipment-based methods tend to document fewer species than equipment-less, search-based methods. Second, opportunistic approaches to sampling based on knowledge of when and where species are likely to occur and be detectable also tend to document more species than more formalized methods, where the place and time of sampling are pre-determined.

Yet, in this survey at Acadia, though incidental encounter was the only method to detect all of the 18 species detected, and was the single most productive method (i.e. produced the greatest numbers of individuals) for 11 of 18 species, only one species, the four-toed salamander, was detected exclusively by this method (Table 3). As an inconspicuous species, and a habitat specialist, it is difficult to detect with standard methods, and experience in this survey indicates that targeted search in sphagnaceous wetlands is the best way to detect this species. That incidental encounters produced fewer exclusive detections than in the southern sites surveyed by Campbell and Christman (1982) and Seigel and Doody (1996) reflects the depauperate nature of Acadia's herpetofauna, and its dominance by generalist species.

Determining which method(s) are most effective depends on an inventory's goals and the habits and habitats of target species likely to be present. Incidental encounter and targeted search detect the greatest numbers of species, and in this survey, was the most productive method for documenting 11 of 18 species (Table 4). Yet, for many of the species detected,

incidental encounter will not provide data useful for estimating population size or structure, habitat preferences, habitat use during different life stages or for different life functions, or distribution. Moreover, as a method, incidental encounter is difficult to replicate in future efforts, lacks rigor from a sampling and statistical perspective, and is essentially qualitative rather than quantitative. Thus, incidental encounter is probably not effective as a "stand-alone" or exclusive method, though it does provide a lot of useful information to augment the standardized methods (Campbell and Christman 1982)

Of the standardized methods, pond time constrained search and anuran call counts were the two most effective methods for documenting most anurans. However, as has been found in Rhode Island (Crouch and Paton 2000), egg mass counts were most effective for detecting wood frog and spotted salamander. Minnow trapping was the most effective method for detecting red-spotted newt and identifying the wetlands they utilize in their larval and adult stages. Upland time constrained search was the most effective method for detecting red-backed salamanders and stream time constrained search most effective for detecting northern two-lined salamanders. Aquatic funnel trapping was the only standard method to detect painted and snapping turtles, though both species were well documented in the course of incidental encounters. However, since incidental encounters of turtles tend to involve females on nesting forays, funnel trapping is more effective if data on population size and structure for a specific site or group of sites is desired. Moreover, for species such as musk turtles, if they do in fact occur at Acadia, funnel trapping would be a more effective approach. Of the standard methods, coverboards were most effective in detecting snakes, though far more were detected as incidental encounters. Yet, coverboards were most effective in detecting red-bellied snakes. Even within a group such as snakes, different species vary in their detectability by different methods. Coverboards tend to be less important for detecting large and mobile terrestrial snakes than they are for detecting small and sedentary species. Though used minimally, drift fencing was not very effective. Considering the time, effort, and materials necessary to erect and monitor on a daily basis, drift fencing is not recommended for a broad, generalized inventory.

Overall, the results of this survey indicate that methods vary in their effectiveness at detecting different species, even those within taxonomic groups such as snakes or anurans. Considering the diversity of amphibian and reptiles and the variability in their size, modes of reproduction, patterns of habitat use, degree of habitat specialization and life history, such a result is expected. To account for this, a generalized, multi-habitat inventory should incorporate a number of different methods. Choice of methods will depend to a certain extent on the relative importance placed on detecting species presence versus generating quantitative estimates of abundance, population size and structure, and habitat comparisons, as well as what the potential species are. Based on the experience at Acadia, time constrained searches, anuran call counts, vernal pond egg mass counts, minnow traps and turtle traps, when augmented by incidental encounters, were most effective for generalized inventory of this park. Where an inventory is more targeted in terms of either habitat type or species, one or two methods, plus incidental encounter would suffice.

Summation

While this inventory provides information on the status of most species known to occur in the park in 2001, it leaves many questions unanswered. In addition to the amphibian declines and possible causes discussed above, the status of the grey treefrog and musk turtle is undetermined. The historic literature (Coman 1987; Davis, 1958; Manville 1938, 1939) suggests these two species were never very common. More definitive determination of their status will require more targeted inventory work. The apparent decline and extirpation of a number of species, as well as the confusion and uncertainty present in the historic record, highlight the importance of a program of standardized monitoring. While a detailed plan for monitoring is beyond the scope of this inventory, the decline of amphibians here suggests that amphibian monitoring, particularly a program of anuran call counts and stream salamander counts should be a high priority. Other important, but lower priorities would be monitoring through egg mass counts, coverboards, and aquatic turtle trapping. Such long term monitoring is important to better separate natural fluctuations in populations over time from anthropogenic declines (Pechmann et al. 1991; Pechmann and Wilbur 1994; Stebbins and Cohen 1995). Though it is based on less than ideal baseline information, the picture that is emerging suggests that, in spite of habitat protection and a fairly remote location, the herpetofauna of Acadia National Park is nonetheless being impacted, likely by factors with distant origins.

Species Accounts

Salamanders

Spotted Salamander (*Ambystoma maculatum*; AMMA)
The spotted salamander is found throughout Maine and was the most abundant salamander recorded in Acadia. It was recorded at 62 localities throughout the park and in all habitats on Mount Desert Island (46 localities), Isle au Haut (15), and one site on the Schoodic Peninsula (Table 2, Fig 8, Appendix 7b and 8b). While it was found predominantly in wetland habitats, this reflects the habitat in which it is most readily detected. It is essentially a terrestrial species as an adult, but dependant on vernal ponds for embryonic and larval development. The spotted salamander breeds in the early spring, migrating on rainy nights from underground burrows to breeding ponds, where mating occurs and females attach gelatinous egg masses to twigs and vegetation in the pond (Petranka 1998). Evidence of this migration was observed in Acadia on 15 and 28 May 2001 when adults were seen crossing Route 233, Route 102, the park loop road at Great Meadow, Indian Point Road, and Duck Brook Road. Adults were captured in the Sunken Heath drift fence traps from 12 April to 16 May, and adults were also found traveling over snow on Duck Brook Carriage Road during a light drizzle on 12 April.

A total of 88 adults and 1080 egg masses (representing 706 adult females) were recorded through egg mass counts, pond/wetland TCS, drift fencing, minnow trapping, and incidental encounters. Collectively, these methods identified Duck Pond, Sargent Pond, Entrance Station Pond, Big Heath Pond, Isle au Haut Pond Site 1 and Site 8, and the ponds at Isle au Haut Eastern Head Thunder Gulch as particularly important sites for spotted salamander breeding. These data suggest that while spotted salamander adults and/or egg masses were found in many ponds, only a small number of the total ponds occupied accounted for most of the breeding effort documented. A survey of spotted salamander use of Rhode Island vernal ponds found a similar pattern (Egan and Paton 2004).

On 11 May, on Isle au Haut, NPS ranger John Cousins directed the survey team to temporary/shoreline ponds at the southern end of Eastern Head Thunder Gulch Ponds where he had seen egg masses and larvae in previous years. The ponds (Appendix 12) are located near the tree line of the shore, in exposed, rocky depressions up to 15 meters above the ocean. They are probably influenced by tides and salt spray during certain periods of the year and would appear to present a hostile environment for amphibian reproduction. Remarkably, hundreds of egg masses were counted in these ponds during egg-mass surveys and as incidental encounters (Table 8, Appendix 8b).

While it is hard to compare the historic accounts based primarily on incidental encounters with the data collected in this survey, which is based on more active methodology, the numbers and widespread distribution of spotted salamanders suggests that this species has not declined.

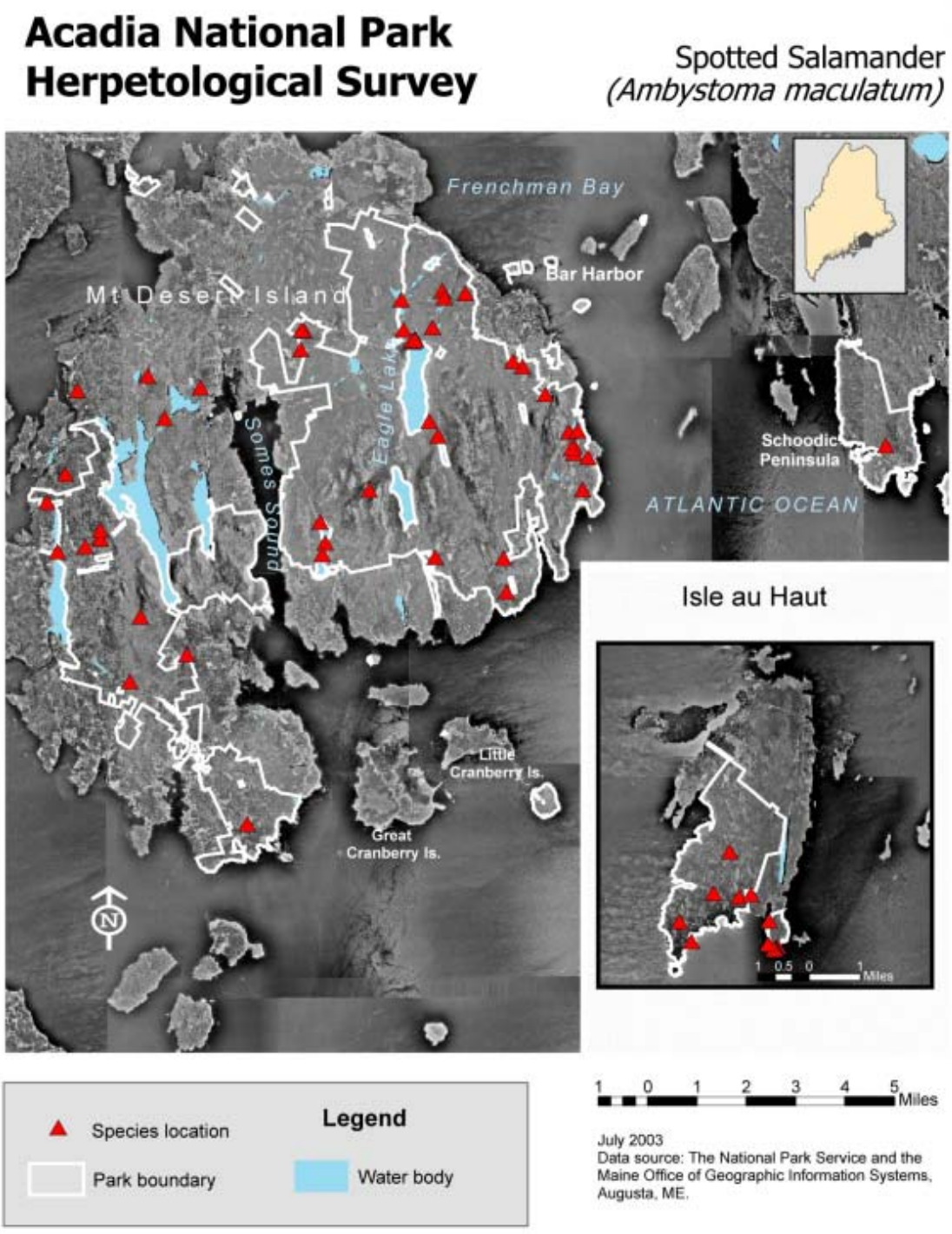


Figure 8. Map of Spotted Salamander found in Acadia National Park during herpetological inventory surveys in 2001.

Eastern Red-backed Salamander (*Plethodon cinereus*; PLCI)
This species is common in the forests of the northeastern United States and southeastern Canada, with the greatest densities in well-drained, mature forests (Petranka, 1998; Pfingsten and Downs, 1989). It was the second most abundant and widespread salamander recorded in this inventory. A total of 139 individuals were recorded from all habitats except tidal areas, at 33 localities on Mount Desert Island and two on Isle au Haut (Tables 1 and 2, Fig 9, Appendix 7b and 8b).

Though recorded in stream and wetland habitats, the red-backed salamander is unique among the amphibians found at Acadia in that it is not wetland dependant at any life stage. Instead of laying eggs in a pond or wetland, the female suspends a grape-like cluster of one to 14 eggs, from the roof of a cavity, such as a hollow log, and attend the eggs until hatching (Petranka 1998). Both embryonic and larval development take place within the egg membranes. On 19 June 2001, two females were found under separate logs, coiled around clutches of seven and eight eggs at Seal Cove Road Woods (west). A subsequent check on 9 August revealed that both females were still coiled around their nests with four and five eggs remaining (see photo of attending female, Appendix 13). The red-backed salamander occurs as a number of different color morphs, with the red striped and all grey unstriped the two most common and widespread in New England (Klemens 1993). Of 37 individuals for which color morph was recorded in this inventory, there were 26 red-striped and 11 unstriped. Davis (1958) also found more red-striped than unstriped morphs.

The eastern red-backed salamander was reported by Manville (1938, 1939) and considered common and widespread by Davis (1958**)** and Coman (1987). Its status does not appear to have changed.

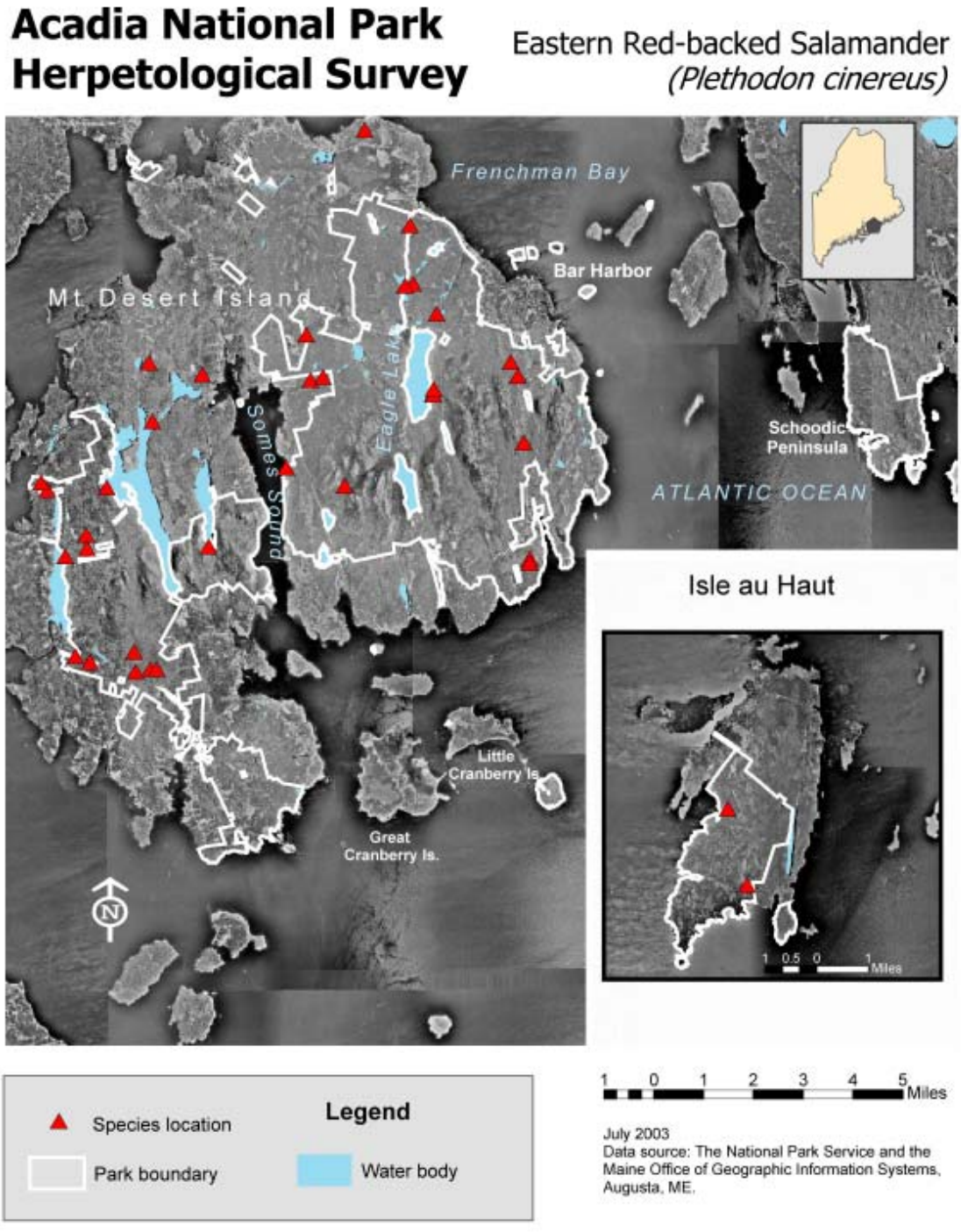


Figure 9. Map of Eastern Red-backed Salamander found in Acadia National Park during herpetological inventory surveys in 2001.

Red-spotted Newt (*Notophthalmus viridescens viridescens*; NOVI)
The red-spotted newt is found in every county in Maine (Hunter et al. 1999). In this inventory, a total of 52 individuals (39 adults, 13 red efts) were recorded from 16 sites on Mount Desert Island and one on Isle au Haut. This is the first record of this species from Isle au Haut. NPS ranger John Cousins found a specimen in Long Pond on Isle au Haut during the survey period (J. Cousins, pers. comm.). The majority of individuals and sites recorded were in wetlands (39 and 11 respectively), followed by roads (11 and 4 respectively) and streams (2 and 2 respectively) (Tables 1, 2, Fig 10). Schooner Head Wetland and Duck Pond accounted for nearly half (19 of 39) of all newts recorded in wetlands. However, complementary research by students from University of Maine at Orono has identified additional localities on Mount Desert Island (M.B. Kolozsvary and J. Cunningham, pers. comm.), indicating that their distribution in the park is more widespread than our results may indicate.

The life history of the eastern newt differs from other salamanders, generally undergoing metamorphosis twice. Adults primarily occur in still bodies of water such as ponds and lakes and are aquatic. Following a typical aquatic embryonic and larval stage, juveniles transform into a terrestrial juvenile stage known as red efts. The eft, bright orange with red spots, may be found under logs and brush or seen moving in woodlands and grassy areas, particularly during rainy conditions (Petranka 1998; Pfingsten and Downs 1989). The efts may spend 2-7 years on land before returning to water and transforming into an aquatic adult, taking on the adult's green coloration and keeled tail (Healy 1974). While red efts may be handled safely by humans, they have toxic skins that deter potential predators (Hurlbert 1970). The newt is considered to be a keystone predator in temporary pond communities where they control insect populations and anuran species composition (Kurzava and Morin 1994). Clear-cut timbering may significantly effect newt populations (Petranka et al. 1993) and repopulation may take 30-60 years (Pough et al. 1987).

Manville (1938, 1939) considered this species uncommon, based on four records and Davis (1958) did not record any. However, the account of Coman (1987) indicates that red-spotted newts are widespread and fairly common. Data collected in this inventory suggest they still are.

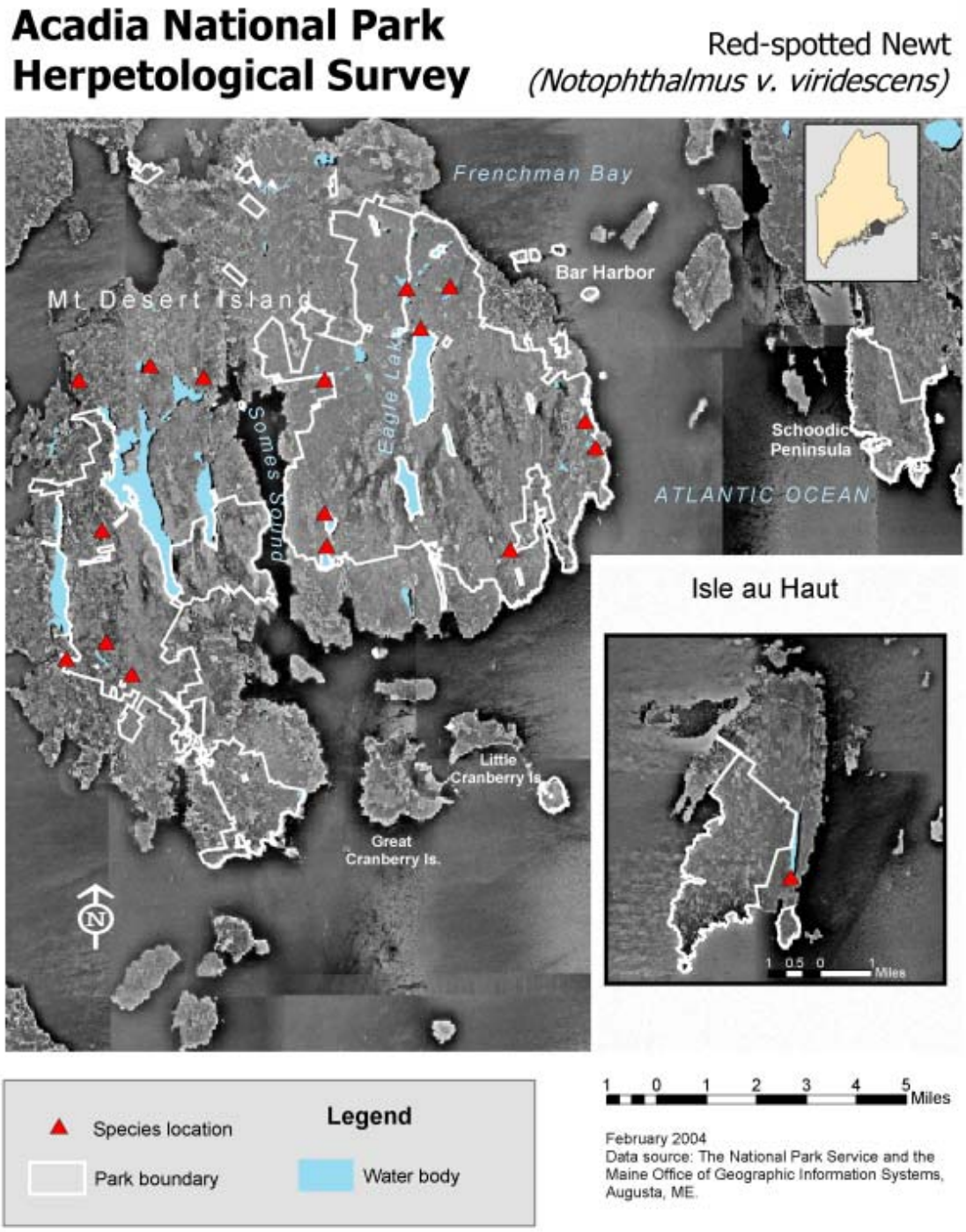


Figure 10. Map of Red-spotted Newt found in Acadia National Park during herpetological inventory surveys in 2001.

Four-toed Salamander (*Hemidactylium scutatum*; HESC)
The Maine Department of Inland Fisheries and Wildlife lists the four-toed salamander as a *Species of Special Concern*. Because of its small size, secretive nature, and specialized habitat (Sphagnaceous wetlands), this species' distribution in Maine is not well documented (Hunter et al. 1999). Such has also been the case at Acadia, and little historic information is available on this species' occurrence (Appendix 1). Davis (1960) noted it being found near Jackson Laboratory, and Coman (1987) reported it from Indian Point Road. Prior to this inventory, the most recent sighting of a four-toed salamander at Acadia was on Duck Brook Road in April 2000 (B. Connery, pers. comm.).

During this inventory, a total of 22 four-toed salamanders were recorded at nine localities on Mount Desert Island. Six were in wetlands and three on roads near wetlands, including Duck Brook Road. (Tables 1 and 2, Fig 11, Appendix 7 and 8). Adults were identified at all nine localities, and nests with attending adults were seen at three of them (Bruce's Vernal Pond, Fawn Pond, and Long Pond Fire Road North 2) (Table 20, Appendix 7b and 8b).

The most effective methods for detecting four-toed salamanders were searches of roads near wetlands on rainy nights and searching in sphagnum dominated wetlands. UMO graduate student, Becky Chalmers identified many new sites after developing a search image that targeted a specific habitat described as "sphagnum cliffs." These are areas of sphagnum moss/sedge that overhang the edge of small ponds, temporary ponds, and marsh pools that are used by nesting salamanders. The nests are created in these clumps and positioned in such a manner that allows hatching larvae to descend the moist moss and enter the water where they spend their aquatic larval stage. Four toed salamanders are similar to spotted salamanders in that they migrate to vernal wetlands to breed in the spring, but otherwise spend much of their time in the woodland habitats adjacent to their breeding ponds (Petranka 1998).

Based on this inventory, it appears that the four-toed salamander is more common in Acadia than historic information suggests. Historic accounts are likely underestimates, and the greater numbers recorded in this inventory are more likely due to greater effort and skill in finding this species than to increased numbers. *Sphagnum* dominated wetlands, the preferred habitat for this species, are common in Acadia and undoubtedly provide a suitable environment for a healthy four-toed salamander population. Its seeming rarity is the result of life history habits that make it difficult to find, even during breeding season. The species get its common name from the four toes on its hind foot while most salamanders have five toes on each hind foot.

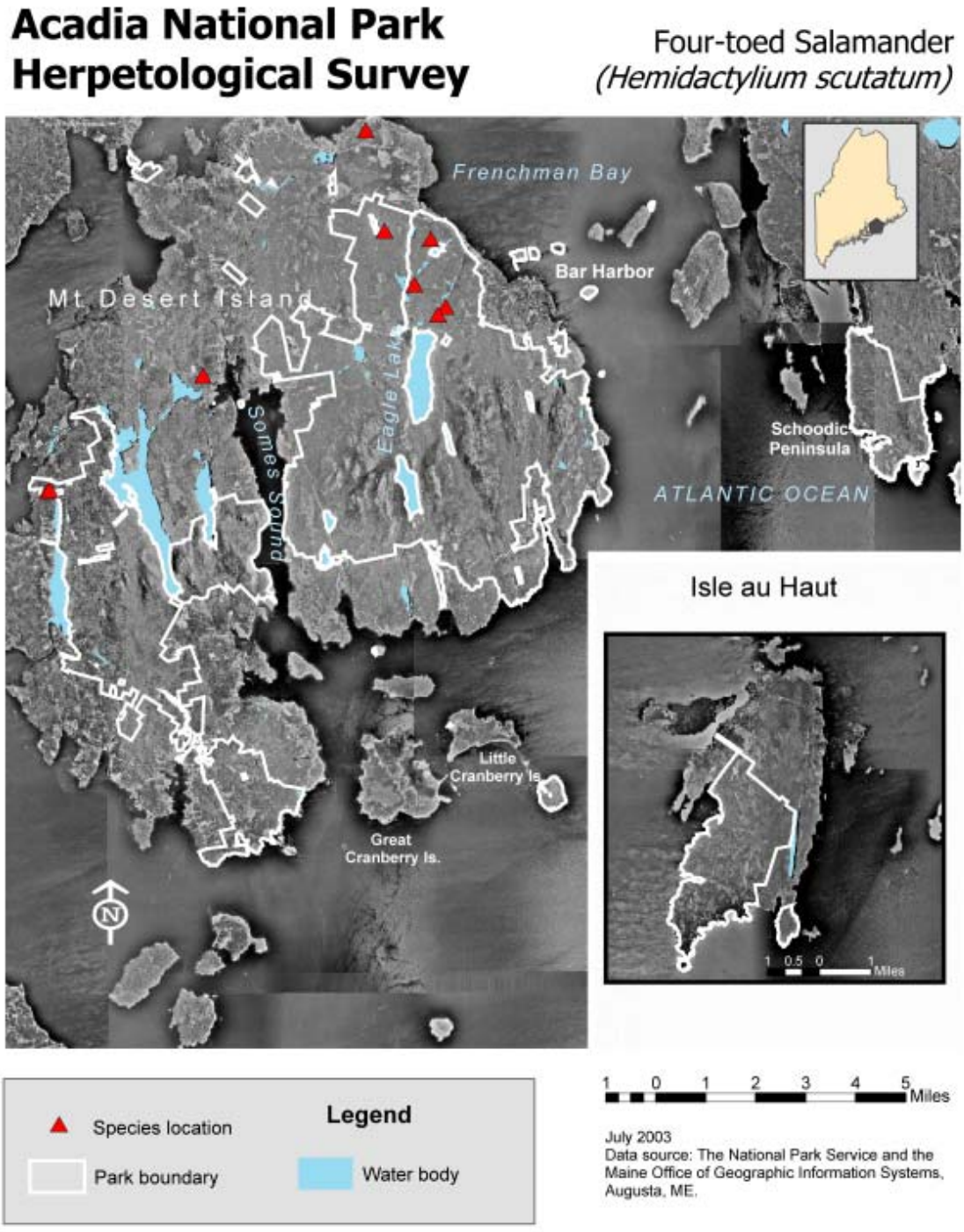


Figure 11. Map of Four-toed Salamander found in Acadia National Park during herpetological inventory surveys in 2001.

Northern Two-lined Salamander (*Eurycea bislineata*; EUBI)
The northern two-lined salamander is primarily a stream inhabiting salamander considered to be abundant in virtually all of Maine's streams and watersheds (Hunter et al. 1999). They are the smallest and slimmest of the state's stream salamanders, recognized by the dark line that extends from each eye down the side of their yellowish body on to the keeled tail.

A total of 41 individuals were recorded at 8 localities on Mount Desert Island. Consistent with known habitat affinities, the majority of individual and sites recorded were in streams (Tables 1 and 2, Fig 12, Appendix 7b and 8b). The majority of animals were recorded during stream time-constrained surveys (Tables 3a and 9) and based on this method, two-lined salamanders were the most abundant stream dwelling amphibian at Acadia. One nest with 13 eggs was discovered during a stream survey in Heath Brook (Table 9). Stream salamander research by Mike Bank (UMO) has identified this species in additional streams throughout Mount Desert Island (M. Bank, pers. comm.).

The northern two-lined salamander is likely the most widespread and abundant stream salamander in New England, and is the most urban tolerant (Klemens 1993), even occurring in a small length of remnant stream at the heavily urbanized Saugus Iron Works NHS in Saugus MA (Cook, pers. obs.). While the two lined salamander was the most abundant stream salamander at Acadia, it was found in only 50% of the streams searched and only Richardson's Brook had what would be considered a relatively high rate of capture. Compared to numbers observed at Saugus Iron Works and at Saint-Gaudens NHS in Cornish NH in the course of this regional inventory, the northern two-lined salamander does not appear to be particularly abundant at Acadia NP. Whether this represents a change in abundance is harder to ascertain. Manville (1938) states that two-lined salamanders are "occasionally turned up", whereas Coman (1987) refers to them as "common and widely dispersed". Davis (1958) recorded 84 (adults and larvae) of this species from 14 different brooks. While the numbers recorded in this survey suggest that two-lined salamanders may have declined since the observations of Davis (1958), without knowledge of her search effort, it is impossible to compare our results with hers. Given the concerns over the impacts of mercury deposition on stream salamanders at Acadia (Bank 2003, Bank et al., in press) and the apparent disappearance of the northern dusky salamander (see next account), further efforts to monitor stream salamanders and the habitat are warranted.

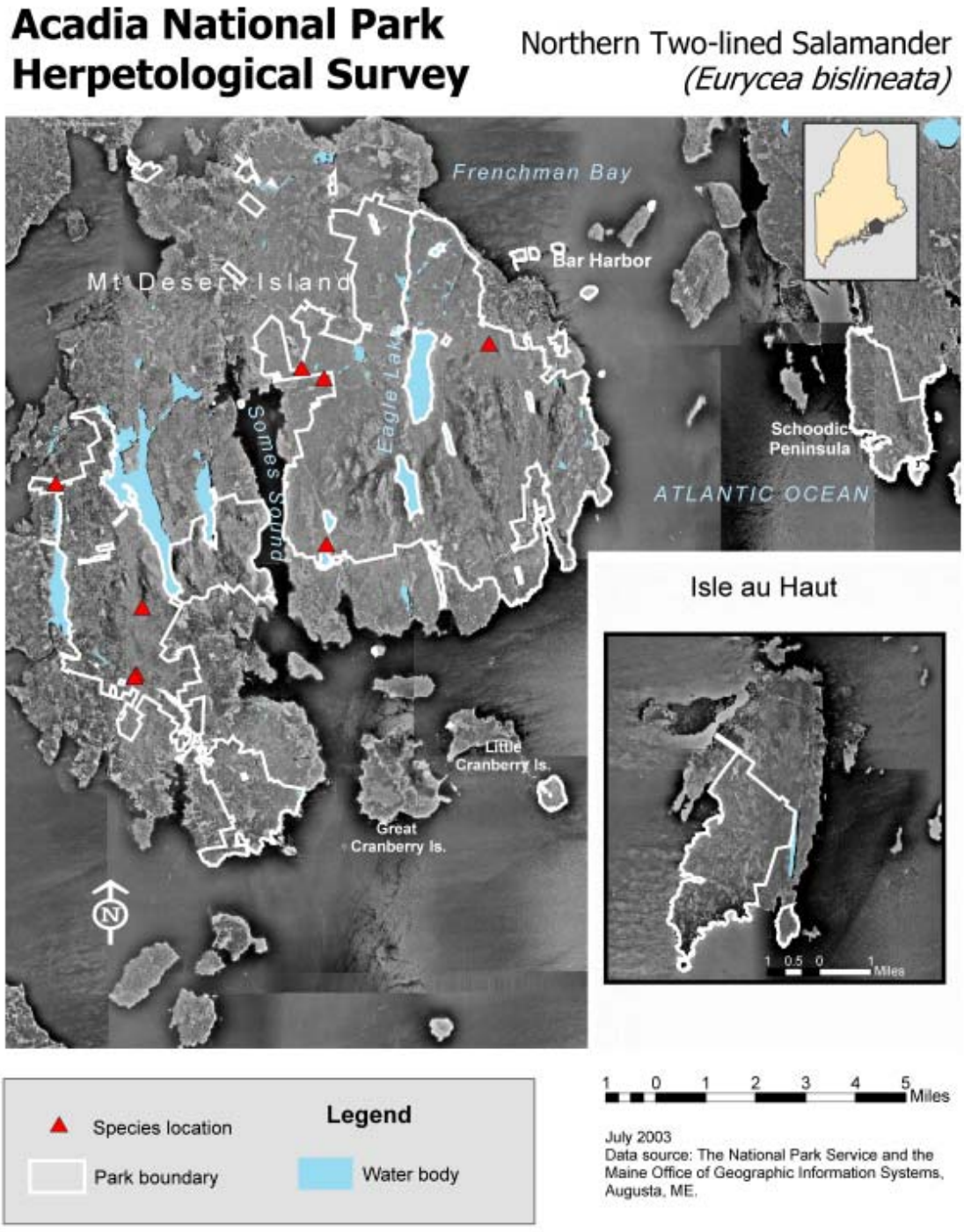


Figure 12. Map of Northern Two-lined Salamander found in Acadia National Park during herpetological inventory surveys in 2001.

Northern Dusky Salamander (*Desmognathus fuscus*; DEFU)
The northern dusky salamander is widespread through Eastern North America and has been found throughout most of mainland Maine, except for the northeastern-most corner (Hunter et al. 1999). Historically, the species was reported by Manville (1938, 1939) from six localities primarily on the east side of Mount Desert Island, and Davis (1958) recorded 16 individuals from six streams, five of which were on the east side of MDI. Favour (1963) reported them at six sites on the east side and one site on the west side of MDI and Coman (1987) reported dusky salamanders in stagnant pools and ditches in Acadia.

No northern dusky salamanders were found in Acadia during 2001 surveys of micro-environments along the edges of forested streams, springs and seeps, their preferred habitats (Petranka 1998, Pfingsten and Downs 1989). In addition, stream searches throughout the park in 2002 by UMO researchers did not find any dusky salamanders, except for two individuals identified as this species. They were found on 28 May 2002, 5 m apart, in Breakneck Stream by J. Crocker, who had prior experience working with dusky salamanders (M. Bank and J. Crocker, pers. comm.). Unfortunately, a voucher specimen was not collected and the photos taken were of such bad quality that identification could not be confirmed (B. Connery, pers. comm). In June 2003, Brian Windmiller lead a team of 13 graduate students on a four-hour follow-up survey in the lower stretches of Breakneck Stream to search for this species. Numerous two-lined salamanders, but no dusky salamanders were found (B. Connery, pers. comm.).

Historical accounts provide no solid data on the abundance of the northern dusky salamander at Acadia. However, they do suggest that they were fairly widespread and moderately common, though probably not as common as the northern two-lined salamander. While the two-lined salamander is still moderately common, the northern dusky salamander appears to be extirpated from Acadia. Reasons for its disappearance are unclear. Klemens (1993) notes that northern dusky salamanders have declined or been extirpated in many urbanized areas, where extensive paving has eliminated many springs and seeps and increased the severity and frequency of stream scouring during storm events. However, the landscape at Acadia has not undergone such changes, and these mechanisms do not seem likely here. Given that the northern dusky salamander is more typically found in habitats that are muddier and richer in organic detritus than two-lined salamanders, and that these muddy, detritus-rich habitats tend to have higher levels of mercury and other pollutants, it could suggest that the disproportionate decline of dusky salamanders at Acadia is related to mercury pollution. However, Bank (pers. comm.) suspects that the decline of stream salamanders in general and dusky salamander in particular is likely the result of multiple factors such as physical changes to the habitat through sedimentation and multiple pollutant stressors. More detailed research is necessary to better understand the interaction between stream salamander life history and the impacts of physical and chemical changes in their habitat.

Frogs

Spring Peeper (*Pseudacris crucifer*; PSCR)
The spring peeper is typically the most widespread and abundant anuran in the northeast and this was the pattern at Acadia as well. It had the highest relative abundance of all 18 species recorded in this inventory and was recorded from 70 sites (25% of all localities) on Mount Desert Island and Isle au Haut (Tables 1 and 2, Fig 13). Moreover, while it was recorded predominantly in association with wetland habitats during the breeding season, it was recorded in all habitat categories (Appendix 7a,b and 8a,b) reflecting the fact that it is primarily a terrestrial species.

In June 2000, a die-off of larvae and adult spring peepers was reported on Mount Desert Island. While the cause was never conclusively determined, field work and necropsies identified a number of possible causal agents. These included an iridovirus (Green and Converse 2000), a chytrid fungus, and other virus and protozoans (Dougherty 2003). Since amphibians are very sensitive to subtle changes in their environment, these agents may well be opportunists that act upon anuran populations stressed by air and water pollution, global warming, and increases in ultra-violet light exposure. Despite this episodic die-off in 2000, spring peepers were abundant throughout Acadia in 2001 and no die-offs were observed. Spring peepers were reported as common and widespread at Acadia by Coman (1987) and still are.

Spring peepers are found in deciduous, coniferous, and mixed woodlands near water bodies. During the breeding season they frequent almost any shallow water body, especially those with standing trees and shrubs, and form choruses (Hunter et al. 1999).

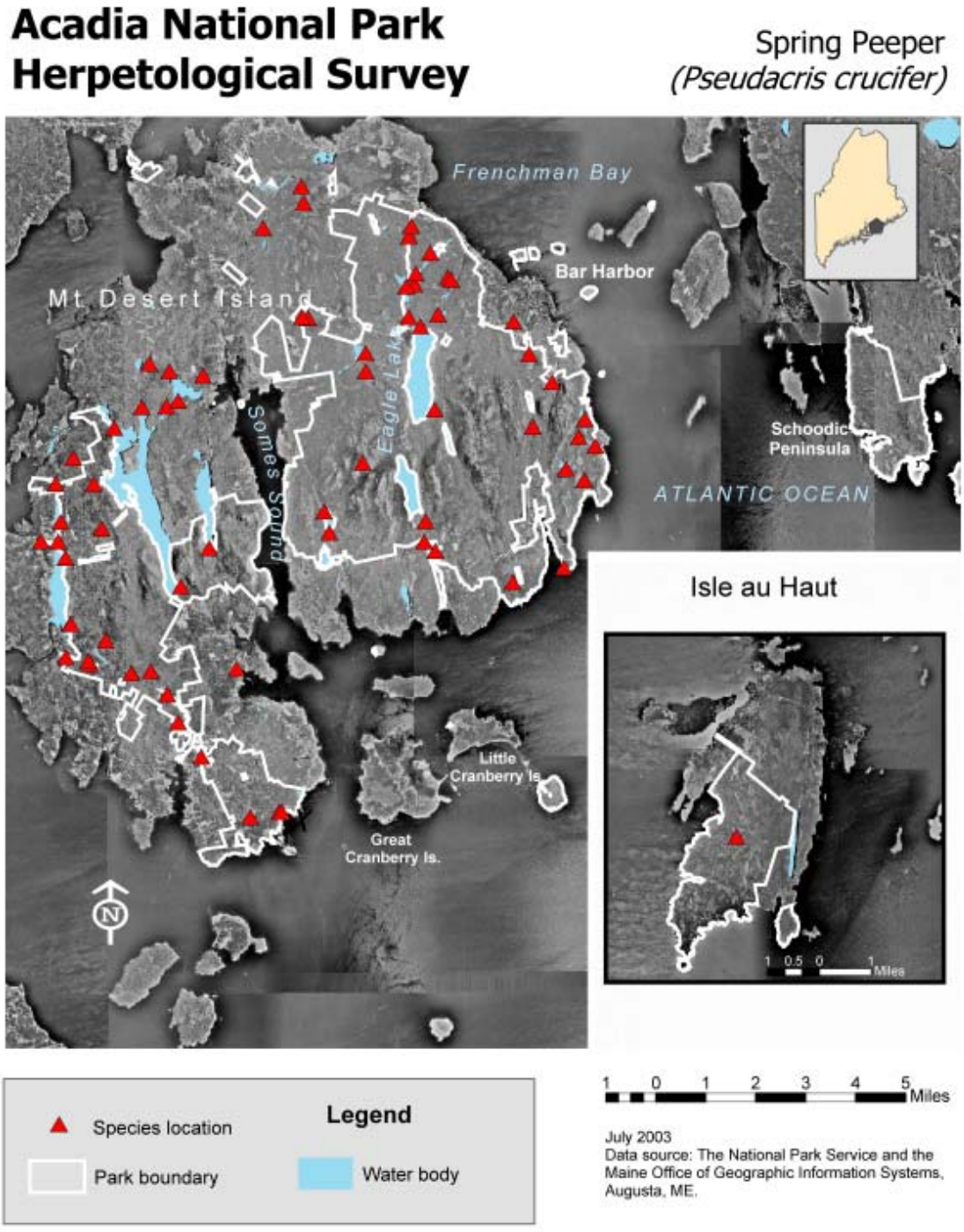


Figure 13. Map of Spring Peeper found in Acadia National Park during herpetological inventory surveys in 2001.

Northern Green Frog (*Rana clamitans melanota*; RACL)
The northern green frog is a common and widespread species in New England (DeGraaf and Rudis 1983) and utilizes a broad range of aquatic habitats (Klemens 1993). It was the second most abundant anuran at Acadia, as well as the third most abundant species overall (Table 1). It was widespread on Mount Desert Island, recorded at 65 sites (23% of all localities), but not recorded on Isle au Haut. While it requires permanent or semi-permanent wetlands for successful reproduction, and was most often found in wetlands (Tables 1 and 2, Fig 14), it was recorded in all habitat categories.

Jesse Cunningham, a University of Maine – Orono (UMO) graduate student, reported an adult green frog that was cyanotic (blue in color), due to a lack of yellow pigment, in a marsh near Half Moon Pond (J. Cunningham, pers. comm.). Others have reported cyanotic green frogs at Acadia as well (Russell and Connery 1997) and cyanotic individuals have been reported in populations of northern green and American bullfrogs in the northeast (Conant and Collins 1998). This species is commonly encountered in Maine in peatlands, vernal pools, springs, and the banks of ponds, lakes, and streams, and wet woodlands (Hunter et al.1999).

Green frogs were considered common by Manville (1939) and were the most abundant amphibian reported by Davis (1958), who recorded 300+ individuals from 49 sites. Our records of 618 individuals from 65 sites suggest that green frog populations at Acadia have remained fairly stable.

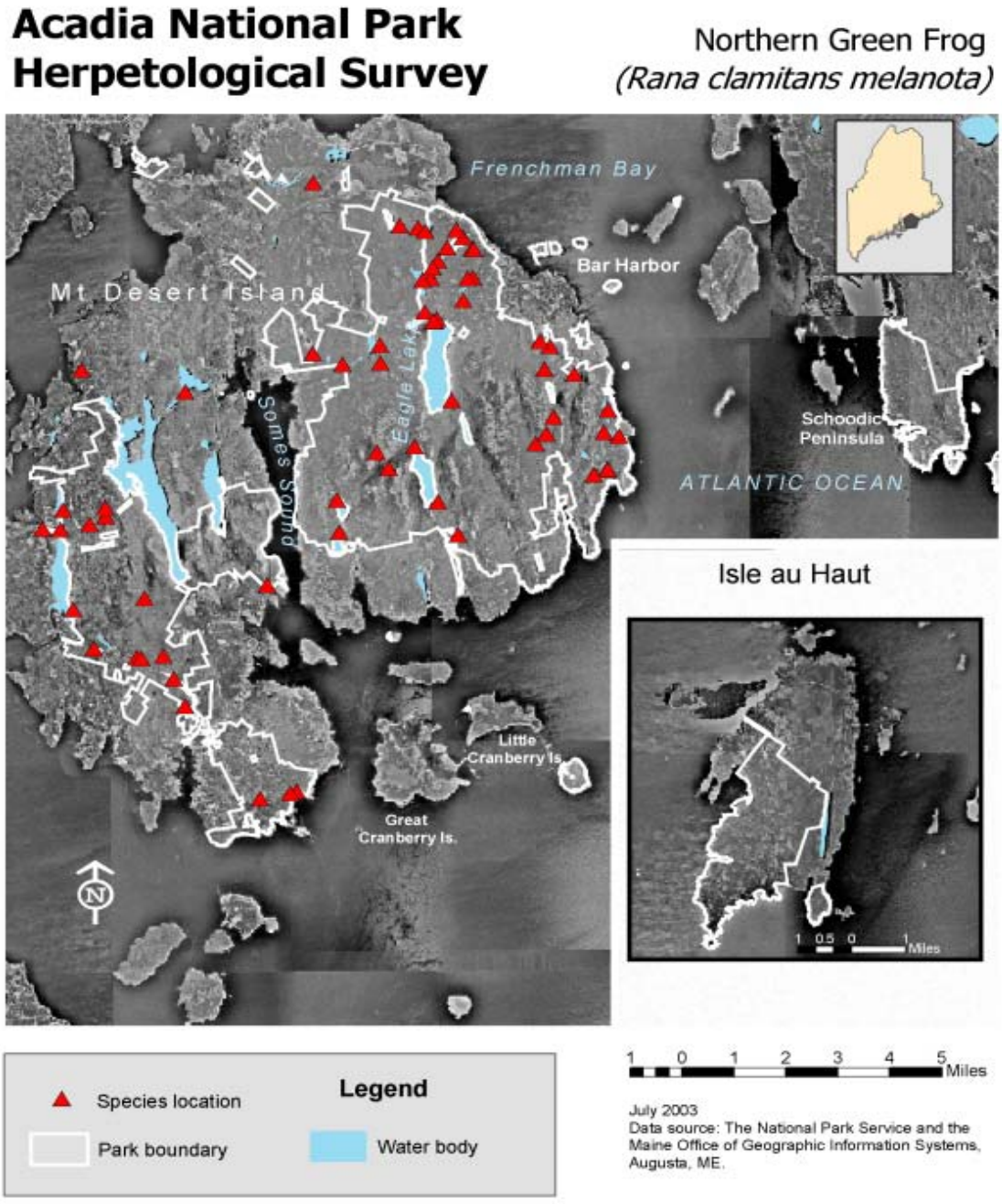


Figure 14. Map of Northern Green Frog found in Acadia National Park during herpetological inventory surveys in 2001.

Pickerel Frog (*Rana palustris;* RAPA)

The pickerel frog is a widespread species that is locally common in New England (DeGraaf and Rudis 1983). At Acadia it was common (Table 1) and widespread. Pickerel frogs were recorded at 51 sites (18% of all localities) on Mount Desert Island in stream, wetland, upland, and road habitats, and on Isle au Haut at Pond Site 4 (Table 2, Fig 15, Appendix 7a,b and 8a,b). The majority of sites were wetlands (38 sites; 73%; Table 2). The only evidence of the pickerel frog on Isle au Haut was an egg mass discovered at Pond Site 4 (Appendix 8). This species is widespread in Maine and inhabits cool spring runs, rocky ravines, and clear water in sphagnum bogs. After breeding, it may move into wet meadows and damp woodlands where it may be confused with the northern leopard frog (*R. pipiens*), which it closely resembles (Hunter et al. 1999). Comparison of our records of pickerel frog (326 inds at 51 sites) with the numbers of individuals and sites reported for this species by Davis (1958) (100+ inds at 35 sites) suggests that pickerel frogs are at least as abundant and widespread as they were in 1958.

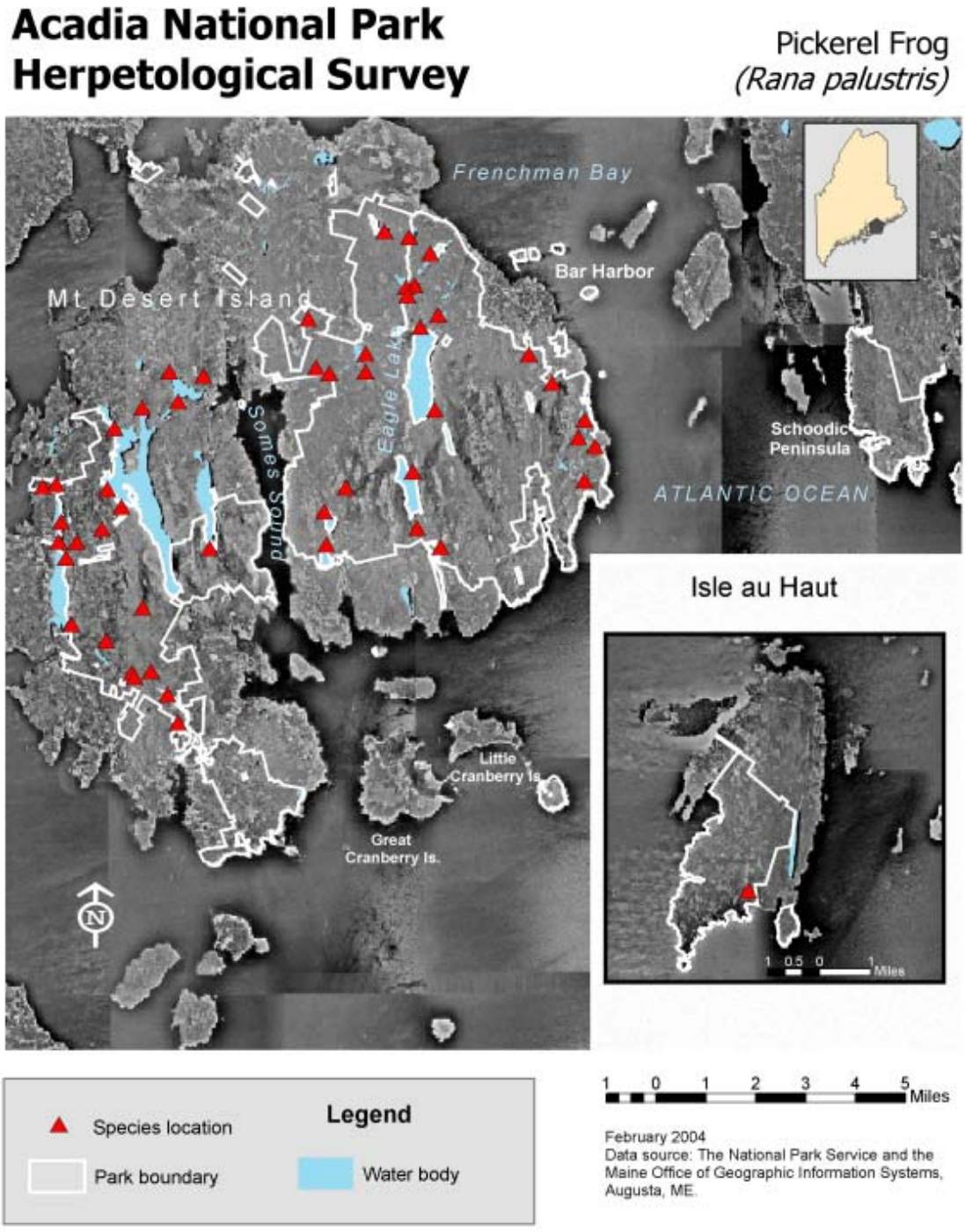


Figure 15. Map of Pickerel Frog found in Acadia National Park during herpetological inventory surveys in 2001.

American Bullfrog (*Rana catesbeiana*; RACA)
The American bullfrog is a widespread and common species throughout much of the northeast, though it is absent from much of northern New England (DeGraaf and Rudis 1983; Klemens 1993). It occurs in all but the northern tip of Maine. Bullfrogs require two or more years for their tadpoles to metamorphose, hence it occurs primarily in open bodies of water such as lakes and permanent ponds (Conant and Collins 1998). Their primary habitat requirement is a permanent water body with abundant emergent and shoreline vegetation (Hunter et al. 1999).

At Acadia, American bullfrog was intermediate in abundance among anurans and fourth in overall abundance with a relative abundance of 0.09 (Table 1). It was also intermediate in terms of its distribution. It was recorded from 36 sites on Mount Desert Island (13% of all localities), 33 of which were in wetlands (Table 2, Fig 16, Appendix 7a,b and 8a,b). The lesser abundance and distribution of this species, compared to spring peeper and green frog, as well as the small numbers of records in non-wetland habitats, probably reflects the bullfrog's need of permanent water bodies for successful reproduction. In addition to our records however, bullfrogs have been recorded at many other sites on Mount Desert Island by UMO researchers over the past several years (J. Cunningham, pers. comm.). Its status at Acadia appears unchanged from that presented by the data of Manville (1938,1939) and Davis (1958).

This species is an aggressive predator that includes other frogs, young turtles, small snakes, and a potpourri of invertebrates in its diet. It is adept at colonizing new habitats, especially those constructed or modified by humans (Lacki et al.1992) and is relatively urban tolerant (Klemens 1993). While native to Acadia, when introduced to areas where they are not native, bullfrogs can displace native species (Stumpel 1992; Adams 1999) and their tadpoles may dramatically alter aquatic community structure (Kupferberg 1994).

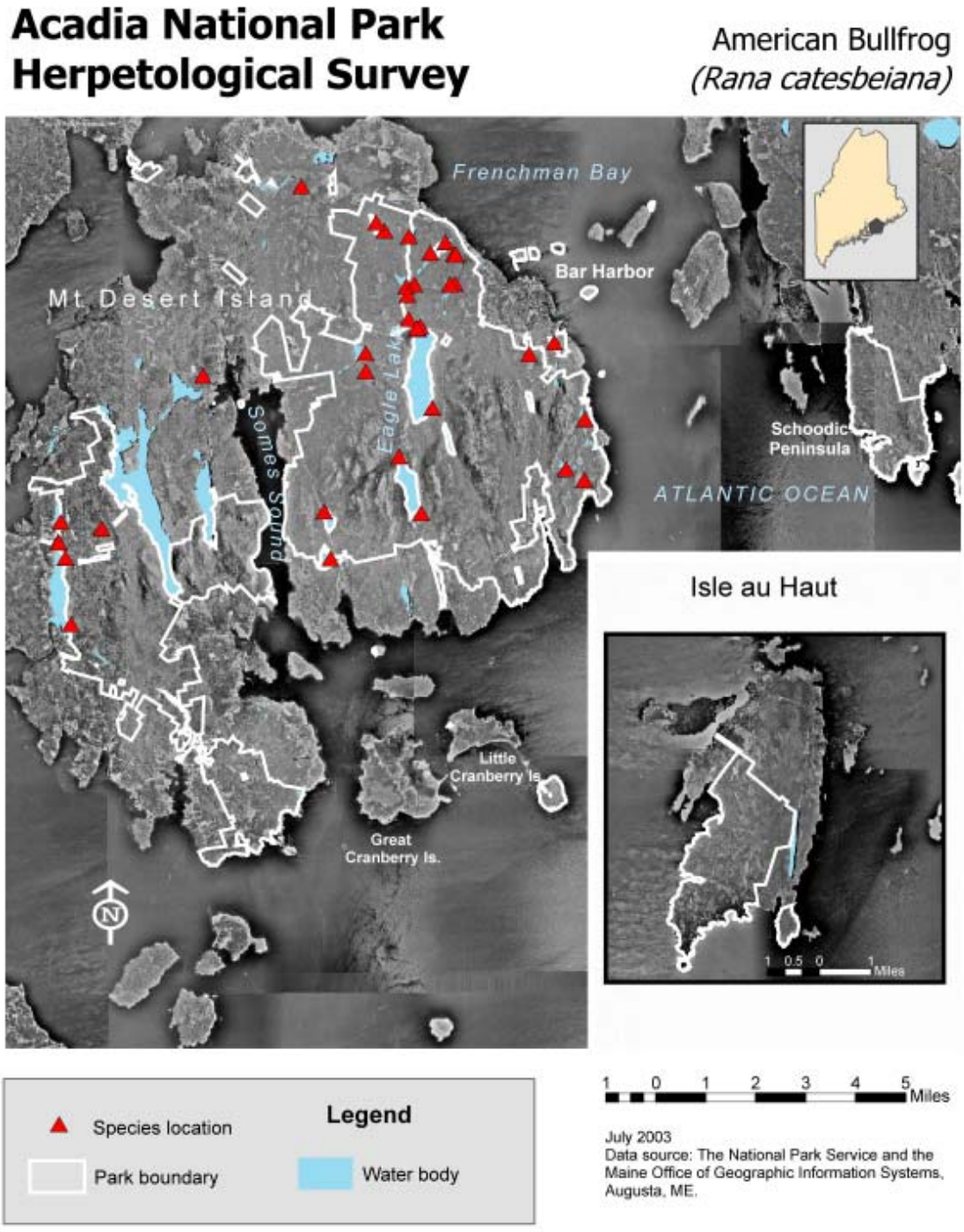


Figure 16. Map of American Bull Frog found in Acadia National Park during herpetological inventory surveys in 2001.

Wood Frog (*Rana sylvatica*; RASY)
The wood frog is widespread in New England and common in suitable habitat, woodlands (Degraaf and Rudis 1983). It is generally regarded to be common in Maine. It is a terrestrial species, occupying moist woodlands except during the breeding season when they breed in fishless semi-permanent water bodies, or vernal pools (Hunter et al. 1999).

Wood frogs were moderately common and widespread at Acadia, with the equivalent of 253 adults being recorded from 26 localities (Tables 1 and 2, Fig 17). Most records of wood frogs involved their egg masses, with lesser numbers involving larvae and adults (Table 3a). Wood frogs were recorded at 21 localities on Mount Desert Island and five on Isle au Haut (9% of all localities), in all habitats except tidal areas (Table 2; Appendix 7a,b, 8a,b). During anuran call counts, calling adults were recorded at only two sites on the east side of Mount Desert Island and none on the west side (Tables 5, 6 and 7). While this suggested that wood frogs were not very common or widely distributed in the park, egg-mass counts, minnow trap surveys, and incidental encounters identified 19 additional localities throughout MDI and five on Isle au Haut, in all habitat categories except tidal (Tables 1 and 2). Detecting wood frogs during anuran call counts is difficult, because they vocalize less frequently than most other anurans, and egg mass counts are a more reliable method for detecting presence and estimating numbers of breeding females (Crouch and Paton 2000, 2002). While it is hard to ascertain the historic abundance of wood frogs at Acadia based on the accounts of Manville (1938, 1939) and Davis (1958), who did not sample in the spring when wood frogs call and lay eggs, data collected in this inventory, coupled with reports from UMO researchers of many sites with wood frogs throughout the park (M.B. Kolozsvary and J. Cunningham, pers. comm.) suggest that the wood frog population at Acadia is little changed.

The majority of wood frog egg masses were identified at the Seal Cove Coverboard Wetland (199; 92% of all egg masses; Table 8). Two egg-mass surveys were conducted four days apart at this wetland. Only three egg masses were found on 20 April, while 199 egg masses were found on 24 April, demonstrating the explosive breeding nature of this species.

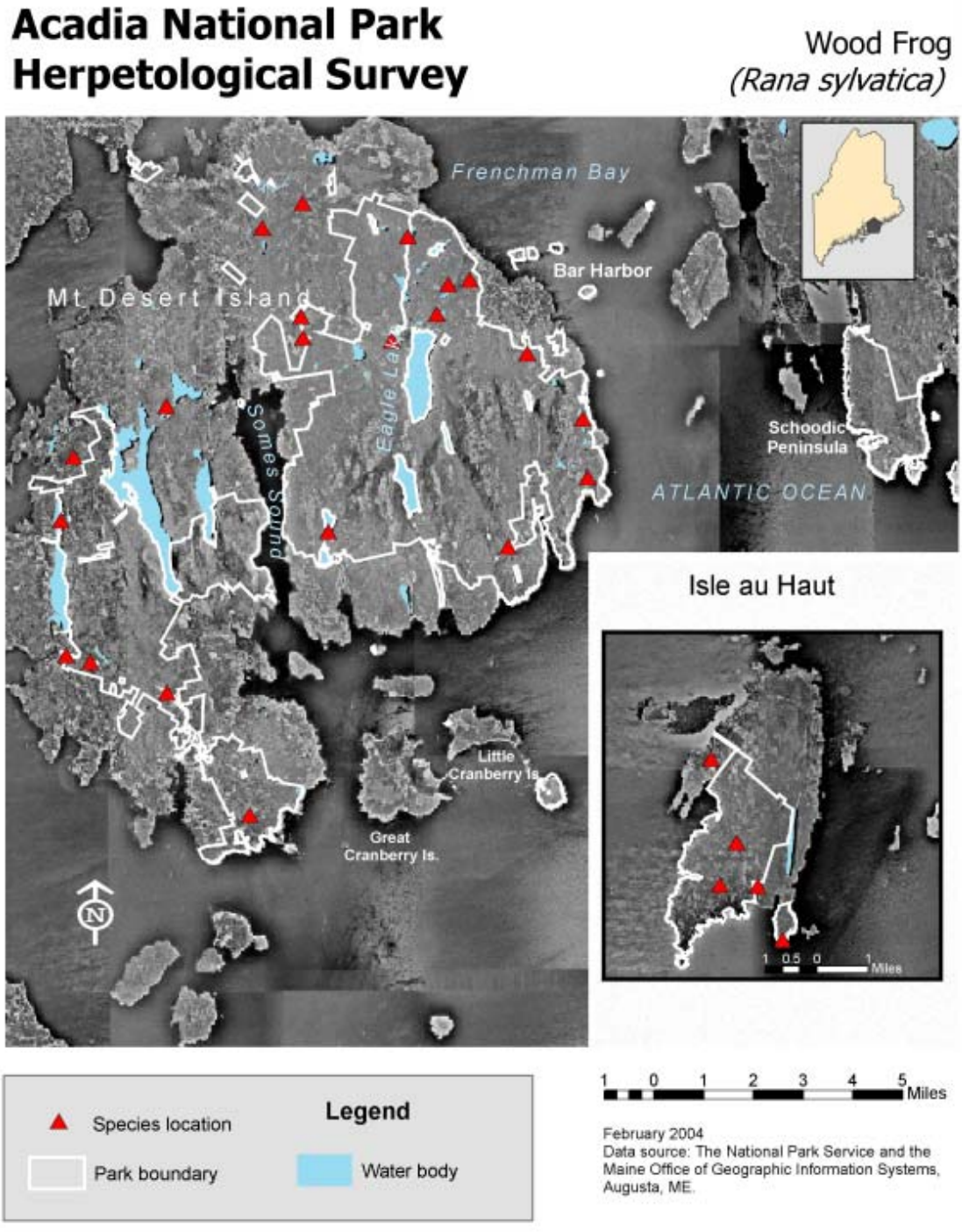


Figure 17. Map of Wood Frog found in Acadia National Park during herpetological inventory surveys in 2001.

American Toad (*Bufo americanus americanus*; BUAM)
The American toad is widely distributed and common in New England (DeGraaf and Rudis 1983). In Maine, it is regarded as common and virtually cosmopolitan in its habitat requirements (Hunter et al. 1999). Similar to spring peeper and wood frogs, it is primarily a terrestrial species, utilizing a wide range of temporary and permanent wetlands for reproduction.

The American toad was uncommon, with only 17 adults recorded at seven sites (2% of all sites), on the west side of Mount Desert Island in wetland and upland habitats (Tables 1 and 2, Fig 18, Appendix 7a,b and 8a,b). Hodgdon Road Pond, located just outside the park boundary at the intersection of Long Pond Fire Road and Route 102, is presumed to be a breeding pond where three adults were heard calling during an incidental encounter on 2 May 2001. American toads were also heard calling from Bass Harbor Marsh, Hio Road Wetland, Hodgdon Pond, and Seal Cove Coverboard Wetland, and adults were captured on Western Trail (Appendix 7b and 8b). Previous to this study, American toads were heard calling near Long Pond Fire Road, Seal Cove Road, and Southwest Harbor (J. Cunningham and B. Connery, pers. comm.). Based upon these observations, the area from Hodgdon Pond south to Bass Harbor Marsh appears to be an area where American toads are relatively common. The scattered wetlands and sandy substrate in this area appear to provide suitable habitat for the toads to reproduce. Search of historical sites including The Tarn and Canon Brook Trail (Davis 1958), far-east side of Mount Desert Island (Favour 1963), and Cadillac Mountain, Thunder Hole, Champlain Mountain (Manville 1938, 1939) was unsuccessful.

Assessing trends in the status of American toads at Acadia is difficult. Manville (1938, 1939) considered it common, but listed only six records. Davis (1958) encountered only two individuals and had few reports of this species from park staff and visitors. She considered it a rare species, and suggested that lack of open habitat was a limiting factor. Coman (1987) shared this view and states that it is not as common as on the mainland. He reports 12 individuals over the course of 15 years. However, while Coman (1987) indicates that this species was presently scarce, he indicates they had once been more numerous in the western part of MDI, prior to 1947. While the different methods employed by these authors make straightforward comparison impossible, these historic accounts, coupled with the small numbers we observed, and our inability to find American Toads at many sites where it had been previously recorded collectively suggest it has declined. This decline merits further investigation.

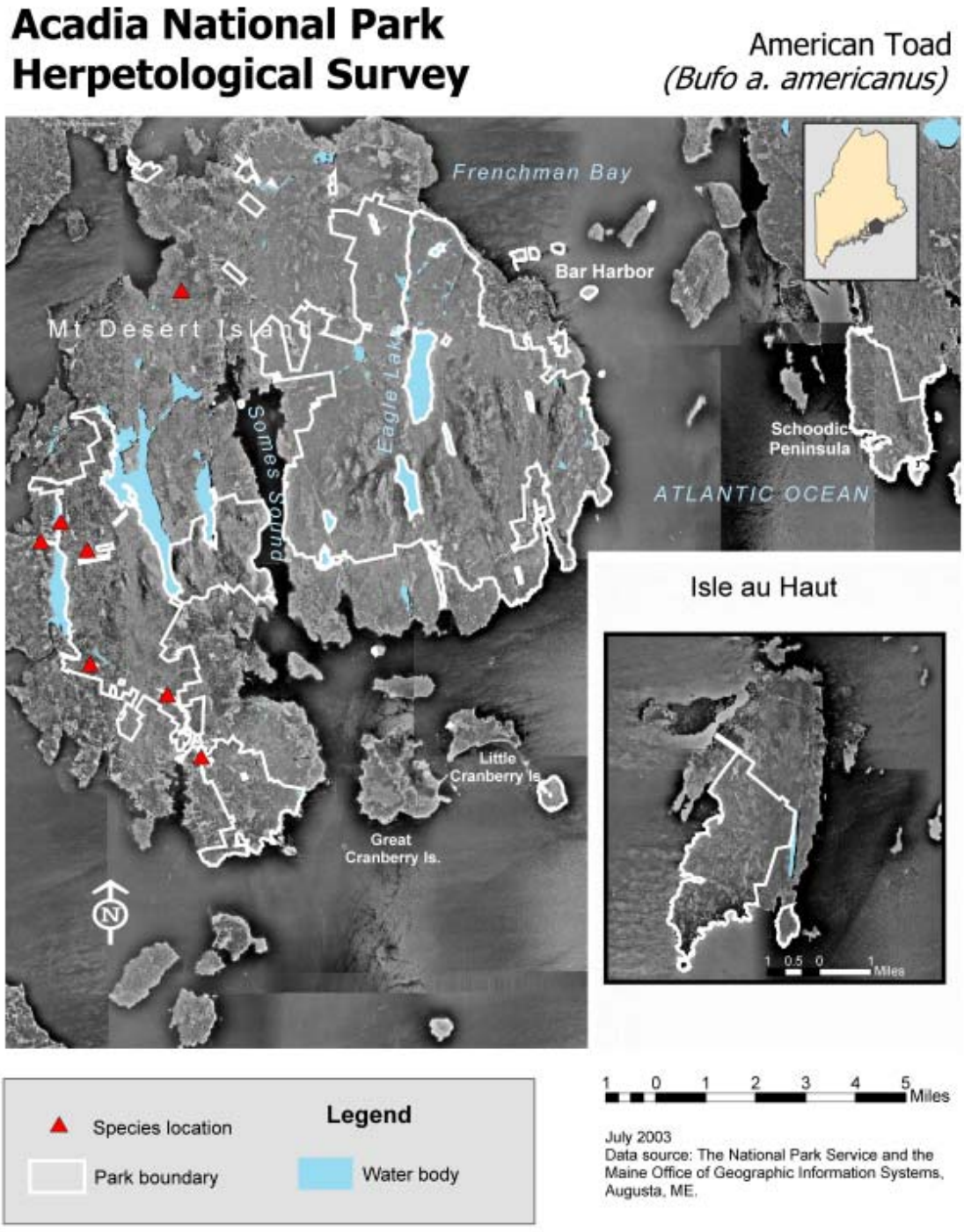


Figure 18. Map of American Toad found in Acadia National Park during herpetological inventory surveys in 2001.

Gray Treefrog (*Hyla versicolor*; HYVE)
The gray treefrog is widespread and common throughout most of New England, though absent from northern New Hampshire and northern Maine (DeGraaf and Rudis 1983). It is not found in northern Maine, but may be relatively common in some parts of the central and southern parts of the state (Hunter et al. 1999). While gray treefrogs reach their northernmost penetration in Maine along the coast, Mount Desert Island lies at the limit of this species distribution in Maine (DeGraaf and Rudis 1983). Manville (1938, 1939) reported gray treefrogs at Acadia, based on two unverified reports. Davis did not observe any herself, but reported it based on one found and photographed by the ornithologist James Bond (Davis 1958, 1960). Coman (1987) also presents several reports based on both vocal and visual identification. Based on these records, we concluded that gray treefrog was historically present at Acadia, but rare, a status consistent with it being at the extreme of its geographic distribution.

There were no confirmed records of gray treefrog during this inventory and it has not been reliably seen or heard in recent years. A volunteer amphibian call count survey included a report of a gray treefrog calling on Mount Desert Island, but this was never verified and no location was specified (Russell and Connery 1997; Connery, pers. comm.). During this survey in 2001, a park employee reported this species calling on the west shore of Hodgdon Pond, but this was never confirmed (Table 20). The employee lacked experience with this species' vocalizations. While the gray treefrogs' call is distinctive, it may be confused with the aggression or alarm call of a spring peeper (Hunter et al. 1999). The spring peeper is an early breeder and calls at low temperatures, while the gray treefrog breeds and typically calls under comparatively warmer conditions. Based on the date and temperature conditions during the above - noted Hodgdon Pond observation, it is likely this is an erroneous report.

While there have been no confirmed records of gray treefrog at Acadia in recent years, it is not clear that this species, apparently rare to begin with, does not still occur. More targeted work is needed. It should be based on replicated call counts in late May, June, and July, and focus on shallow wetlands, particularly those with shrubby vegetation (Klemens 1993). Considering historic accounts, primary focus should be on the west side of Mount Desert Island.

Northern Leopard Frog (*Rana pipiens*; RAPI)
While the northern leopard frog is known from the entire state of Maine, an apparent dramatic decline in its population has lead the Maine Department of Inland Fisheries and Wildlife to list it as a *Species of Special Concern* (Hunter et al. 1999). These declines have been noted range-wide and may be the result of the cumulative effects of habitat loss or succession (large open grassy areas, wet meadows), disease episodes, pesticides, and increased ultra-violet light exposure. The area affected by this widespread decline includes Acadia NP, where this species appears to be extremely reduced, if not extirpated.

Historically, northern leopard frogs were reported to occur throughout the park on Mount Desert Island (Appendix 1). Manville (1938, 1939) reported it as common, listing seven localities on both the east and west sides of Mount Desert Island where it had been recorded from. Conversely, Davis (1958) did not find any leopard frogs but did record 100+ pickerel frogs (*Rana palustris*), a species that is often confused with leopard frogs. Favour (1963) reported leopard frogs at Sargent Mountain, but provides no description. Coman (1987) reported northern leopard frogs to be plentiful in "the large marshy beaver flowage on the opposite side of the road from the Precipice". However, he also reports that in spite of intensive searches in the springtime he was unable to find leopard frogs from ca. 1947 to 1981. Coman characterized this as a "disappearance" and implied a return of leopard frogs to Acadia, where they were restricted (as of 1987) to only two or three locations.

While these conflicting reports initially cast doubt on the accuracy of the original reports of leopard frog at Acadia, Manville (1938, 1939) reported both leopard frog and pickerel frog present, and provided accurate descriptions of both species. Moreover, Davis (1958) corresponded with Manville regarding her failure to find leopard frogs, and does not raise any doubts regarding the accuracy of Manville's accounts of leopard frog occurring at Acadia. Rather, she speculated that pickerel frogs may have replaced leopard frogs through competitive exclusion, though she offers no explanation for what the proximate cause might have been. These reports, plus those by Coman (1987), who also discussed both leopard frog and pickerel frog, lead us to accept that leopard frogs were historically present.

In the course of this inventory, extensive search of wetland habitats for leopard frog, including the site where Coman (1987) reported them to be abundant, known as Schooner Head Wetland in this study, failed to record any. Other recent accounts of possible records of leopard frog at Acadia are also questionable. One was reported during a volunteer anuran call count conducted in 1997 (Russell and Connery 1997), but no description was provided. Follow up sampling by several researchers was negative (Connery, pers. comm.). Jesse Cunningham (UMO) reported what sounded like a single northern leopard frog call from Blackwoods wetland on 14 May 2000 (J. Cunningham, pers. comm.). His extensive efforts to hear additional calls or observe adults or egg masses were not successful. Given that our efforts in 2001, plus those of many others over a few year period have failed to confirm this species, it seems likely that it is at the very least greatly reduced, if not extirpated.

The decline, if not total disappearance of leopard frog from Acadia is consistent with broader declines in this species reported throughout Maine (Hunter et al. 1999) and southern New England (Klemens 1993). While some of the decline in leopard frogs throughout the

Northeast is due to loss of habitat (e.g. riparian wetlands), Klemens (1993) cites Schlichter's (1981) report that optimal conditions for fertilization and development of leopard frog eggs occurs at pH 6.0 and above, and suggests that leopard frogs may be more sensitive to acid precipitation than other anurans. Others also report that embryonic acid tolerance is greater in pickerel frogs than leopard frogs (Freda et al. 1991), with significant (50%) mortality in pickerel frogs occurring at pH 4.2 - 4.4, as opposed to pH 6.0 in leopard frogs (Pierce 1985). Davis (1958) presents pH data on Acadia wetlands where amphibians were recorded. For 58 sites, the range was 3.0 to 6.5, but only two sites were above pH 6.0, and 51 were pH 5.0 or less. These data indicate that in 1958, pH conditions of Acadia wetlands were far more favorable to the reproductive success of pickerel frogs than leopard frogs. While this suggests that acid precipitation may be a partial cause of the disappearance of leopard frogs at Acadia, analysis of historic trends in wetland and precipitation pH is beyond the scope of this inventory. Moreover, the presence of iridovirus, known to affect the genus *Rana* and occurrence of anuran die-offs at Acadia (Green and Converse 2000) suggest that it may well be a combination of factors.

The identification of the leopard frog is very often confused with the more common pickerel frog. Both species have distinct blotches down their dorsum; the leopard frog's spots are oval and more irregular in distribution than the rather uniform double row of square spots that appear on the pickerel frog (Appendix 12). Additionally, the leopard frog is typically greener in color and lacks the bright yellow-orange coloration present on the undersurface of the hind legs of pickerel frogs (Conant and Collins, 1998). Neither voucher specimens, nor photographs, of MDI leopard frogs are known to exist.

Turtles

Painted Turtle (*Chrysemys picta*; CHPI)

The painted turtle is widespread and common throughout New England (DeGraaf and Rudis 1983) and is the region's most familiar and conspicuous turtle (Klemens 1993). It occurs in a wide a variety of permanent and semi-permanent ponds, lakes, marshes, swamps, and slow-moving rivers. The painted turtle is the most commonly observed turtle at Acadia and was the most frequently captured and incidentally encountered turtle in this study (290 adults; Tables 1 and 3b, Fig 19). It was also the most numerous reptile (Table 1). It was recorded at 29 sites (10% of all localities), mostly wetlands, but also on roads and in tidal habitat (Table 2, Appendix 7a,b and 8a,b). Of the 90 painted turtles captured and measured (Appendix 10), 30 (33%) were from Little Turtle Pond on MDI. This site also had the largest estimated population of painted turtles, 76 individuals. Other ponds where trapping estimated moderate numbers of painted turtles were North Breakneck Pond, Fawn Pond, Northeast Creek, and Beaver Dam "Muck Pond" (Table 17). One road-kill specimen was found on Route 233 between Little Turtle Pond and Eagle Lake, and another was found on Route 102 on the west side of Mount Desert Island west of Seal Cove Pond (Table 17).

Painted turtles occur throughout Mount Desert Island and also on Isle au Haut. Prior to 2001, the painted turtle had not been documented south of Seal Cove Road on the west side of the island (A. Rhodin, pers. comm.). In June and August 2001, USGS researcher Paul Wilson reported painted turtles to be present at Two Moose Pond, adjacent to Bass Harbor Marsh, making this the southern-most location on MDI known to support this species (Fig. 7). On the island's north end, trapping in the southeastern reaches of Northeast Creek recorded populations of both painted and snapping turtles (Table 17). Most of the painted turtles were captured in the area closest to Crooked Road and furthest from tidal influenced waters. The snapping turtles were found further down the creek, approximately 200 meters northwest of its confluence with the Hamilton Pond drainage. No painted turtles were observed or captured during extremely limited trapping and search effort on Isle au Haut. However, ranger John Cousins has seen painted turtles basking on logs at the southern end of Long Pond in previous years (J. Cousins, pers. comm.).

Additional painted turtle surveys were conducted in late June and early July 2001 to assist Anders Rhodin with a study initiated in 1992 to monitor the nesting success, clutch size, weight, and nesting frequency of this species at Witch Hole Pond, Little Turtle Pond, and Aunt Betty Pond (see Rhodin 1992). Females used the loose gravel along the shoulders of the carriage roads bordering Witch Hole Pond and Aunt Betty Pond as nest sites. Females also nested in the rocky outcrops and large areas of exposed rock with little vegetation that were located in the woodlands adjacent to these wetlands (A. Rhodin, pers. comm.). Nest cavities were dug in the humus that collected between large rock slabs and in small patches of soil found near the rocky outcrops. Many females nest twice during the summer and the eggs are frequently preyed upon by raccoons (A. Rhodin, pers. comm.).

Manville (1938, 1939) did not list painted turtles as occurring on Mount Desert Island. Coman (1987) did not observe any in 1947, but did so by the 1970's. As of 1987 they had become common. These accounts led Rhodin and Ressel (1995) to suggest that either

painted turtles had been recently introduced onto MDI, possibly as research animals released from Jackson Labs, or that they had been present all along, in small numbers. In this second scenario, they attributed the recent increase to increased available habitat and reproductive output due to recent landscape changes, such as the creation of carriage roads and beaver impoundments. More recently, Rhodin (pers. comm.) has examined Manville's notes and concluded that he was using colloquial terms for what were, in fact, painted turtles. Thus, Rhodin (pers. comm.) believes that the latter of his two scenarios is the correct one. The presence of painted turtles on Isle au Haut, and other nearby islands also supports this. While it is possible that painted turtles could have been introduced to these islands, 10 additional species of amphibians and reptiles were recorded on Isle au Haut (Table 1). It is unlikely that all these were introduced there. A more plausible explanation is that they advanced northward during the retreat of the last glacier before sea level had risen sufficiently to isolate Isle au Haut. Painted turtles also occur on several islands off the south coast of Massachusetts (Lazell and Michener 1976). Thus, painted turtles are likely native to MDI, and their numbers have increased since the time of historical accounts.

Research by Rhodin (1992) indicated that the painted turtles on Mount Desert Island represent hybrid intergrades of the eastern painted turtle (*C. picta picta*) and the midland painted turtle (*C. picta marginata*) two subspecies. The eastern painted turtle has an unmarked yellow plastron and the seams on the carapace are aligned, whereas the midland painted turtle has a variable dark marking on the center of the plastron and alternating seams on the carapace (Ernst et al. 1994). Populations of hybrids have individuals that vary in these characters, with most individuals being intermediate.

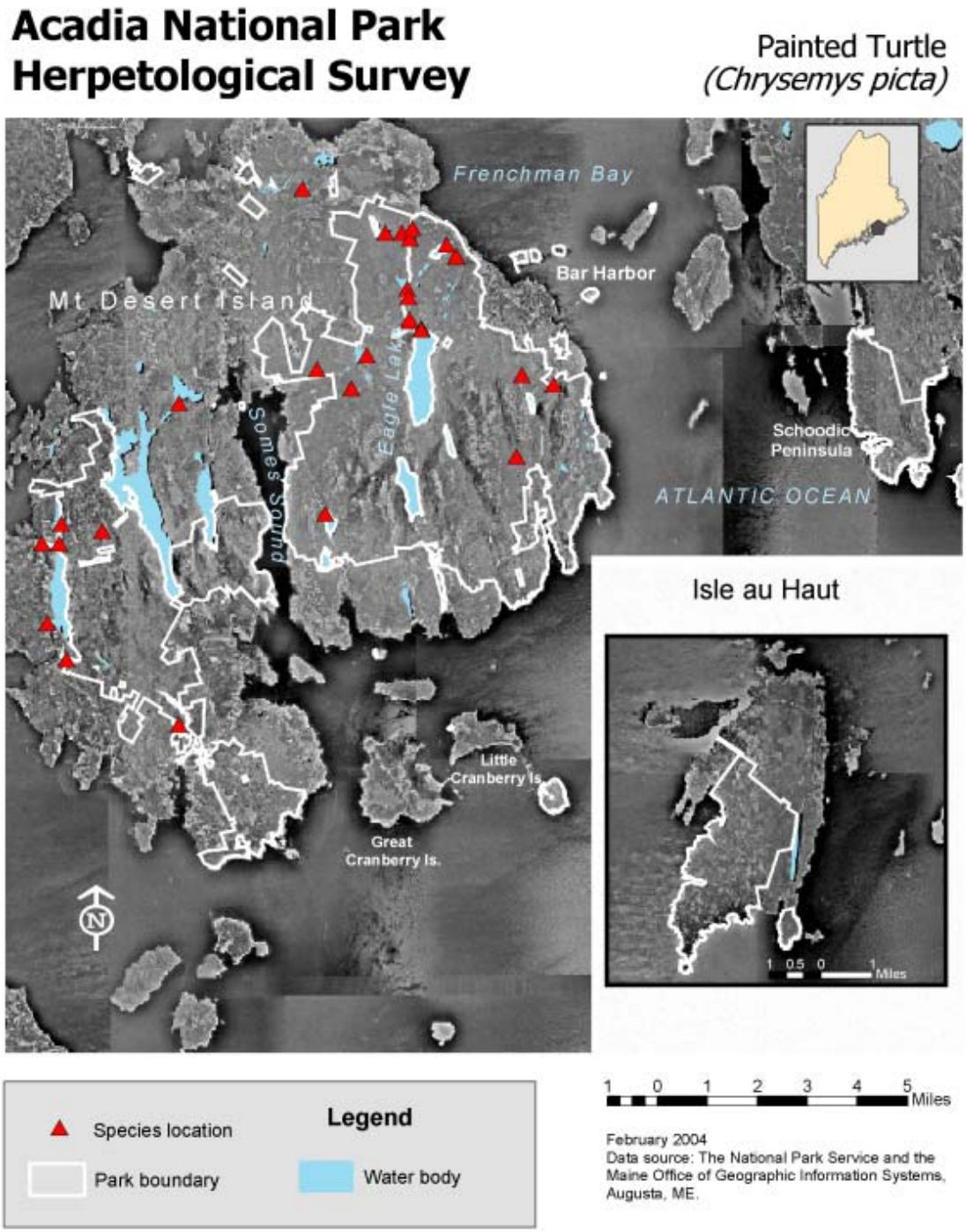


Figure 19. Map of Painted Turtle found in Acadia National Park during herpetological inventory surveys in 2001.

Snapping Turtle (*Chelydra serpentina*; CHSE)
The snapping turtle is common in central and southeastern Maine, but does not penetrate very far into the northwestern highlands. While painted turtles are more commonly seen because they display themselves while basking, the more cryptic snapper may be the most numerous turtle species in Maine (Hunter et al.1999).

The snapping turtle was the second most captured and encountered turtle species at Acadia (86 adults; Tables 1 and 3b, Fig 20). It was recorded at 29 sites (10% of all localities) mostly in wetlands, but frequently on road and in one tidal habitat (Table 2; Appendix 7a,b and 8a,b). Of the 47 individuals captured and measured, 11 (23%) were from Northeast Creek (Appendix 11). However, based on trapping, estimated populations were greatest in Geronimo Pond (N=20), Northeast Creek (N=11), and North Breakneck Pond (N=11). One snapping turtle was captured on 1 May, crossing Route 233 between Little Turtle Pond and Eagle Lake. A specimen captured in Northeast Creek had notches assigned by Anders Rhodin some years before. Rhodin never trapped or marked any turtles in Northeast Creek and suspects that this individual was one captured in Hamilton Pond several years earlier and that it had moved down the drainage that connects Hamilton Pond to Northeast Creek (A. Rhodin, pers. comm.). No snapping turtles were observed or captured during limited trapping and searching on Isle au Haut during this study. However, ranger Wayne Barter has seen this species in a marsh near Robinson Point on Isle au Haut in previous years (W. Barter, pers. comm.).

Manville (1939) considered the snapping turtle to be the most abundant turtle on MDI. Coman (1987) indicated that, beginning in the 1970's, painted turtles began to increase and eventually became more abundant, but snapping turtles were still widespread and common. The results of this survey indicate that snapping turtles continue to be widespread and common, and that the change in their ranked abundance among turtles is due to an increase in painted turtles rather than a decline in snapping turtles. Snapping turtles are among the most tolerant of pollution and habitat degradation, and unlikely to be a conservation concern at Acadia.

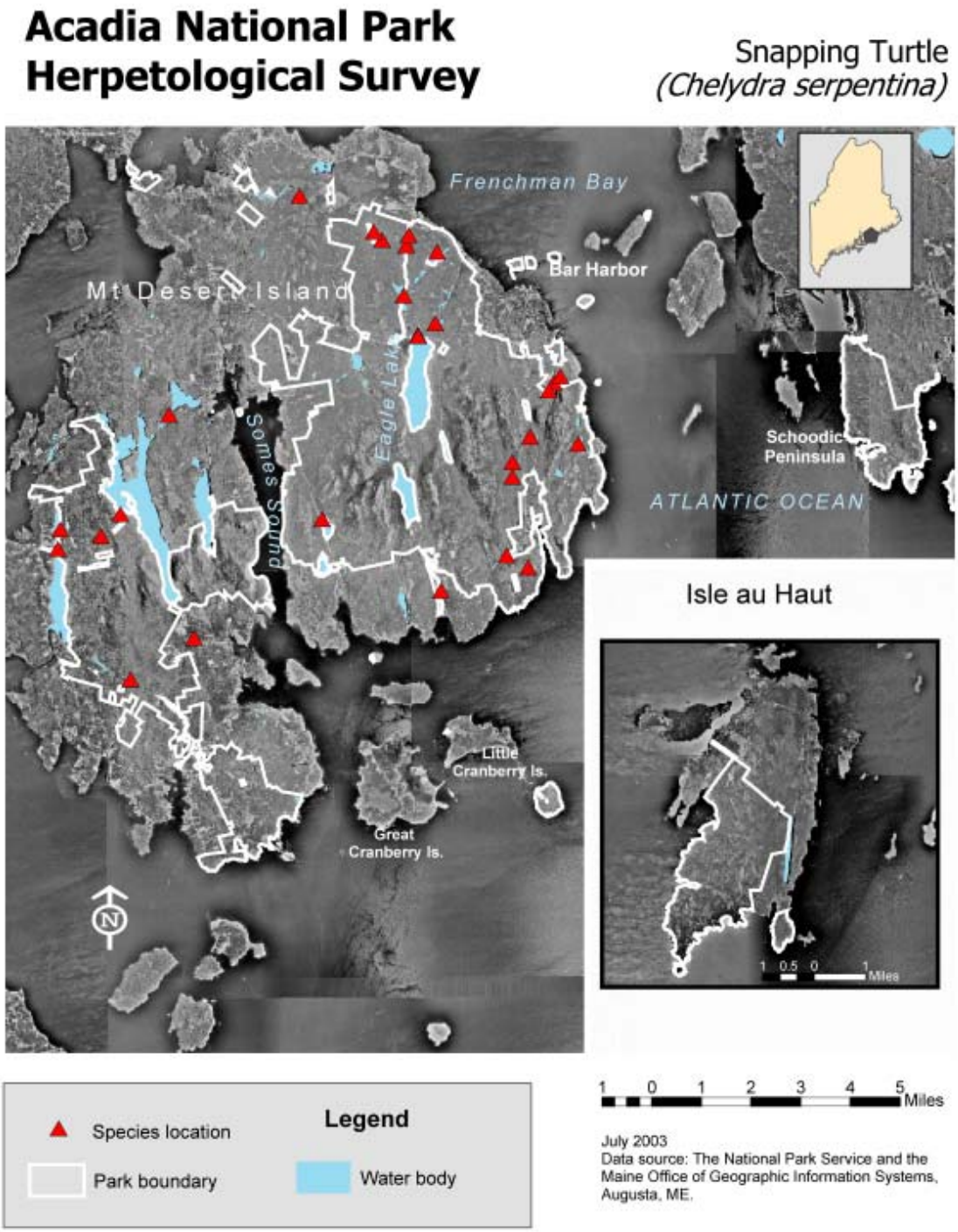


Figure 20. Map of Snapping Turtle found in Acadia National Park during herpetological inventory surveys in 2001.

Wood Turtle (*Glyptemys insculpta*; GLIN)
The wood turtle occurs in southeastern Canada, northeastern and northern areas of Midwestern United States. It has been listed as *Endangered* or *Threatened* in many of the states and provinces in which it occurs. This species has been observed in all of Maine's major river drainages but populations may be quite localized (Hunter et al. 1999). The Maine Department of Inland Fisheries and Wildlife lists it as a *Species of Special Concern*. Coman (1987) described an individual found by Paul Favour in 1958 near Bar Harbor. This animal was believed to be a released pet. James Perkins reported another encounter of a wood turtle in his driveway at Indian Point (Rhodin 1992). The specimen was collected in May 1989, photographed and released. Rhodin examined the photograph and confirmed the identification, but believes it was more likely another released pet than from a naturally occurring population (A. Rhodin, pers. comm.). In 2001, an unconfirmed account of a wood turtle on Mount Desert Island was reported by Liz Willey (USGS wetland technician). A friend of Willey's observed a road-kill turtle thought to be a wood turtle somewhere on Crooked Road while visiting in June. Unfortunately, the specimen was not collected and the photos taken were of bad quality. Based upon the 2001 survey, and the apparent absence of suitable habitat and lack of verifiable voucher material and historical data, it seems unlikely that the wood turtle occurred naturally in Acadia.

Blanding's Turtle (*Emydoidea blandingii*; EMBL)
According to McCoy (1973), the heart of the Blanding's turtle population in North America lies in the Midwest, with disjunct populations in New England and Nova Scotia. Historically, this species possibly inhabited the freshwater marshes and ponds of eastern coastal Maine. However, its current known range in the state is limited to York County and western Cumberland County, in extreme southern Maine (Hunter et al. 1999). The Maine Department of Inland Fisheries and Wildlife list the Blanding's turtle as *Endangered* because of its restricted range and low population.

Favour (1963) reported an individual specimen from near Bar Harbor in the 1950's. Coman (1987) believed that animal to be a released pet and that there was no naturally occurring population in Acadia. Based upon the absence of any observations of this species during the 2001 survey and the lack of voucher material and verifiable historical data, there is nothing to suggest the occurrence of Blanding's turtle in the wild at Acadia.

Stinkpot (*Sternothorus odoratus*; STOD)
The stinkpot is a widespread species in the Eastern U.S whose northward extension along the coast is limited primarily to southern New England. It occurs in a broad range of waterways with slow currents and soft bottom, including rivers, streams, lakes, and ponds (Ernst et al. 1994). Though widespread, in southern New England it is irregularly distributed and locally abundant (Klemens 1993). Northern coastal Maine is the northern limit for the stinkpot, and they are found on the mainland in limited numbers (Hunter et al. 1999). The Maine Department of Inland Fisheries and Wildlife lists the stinkpot as a *Species of Special Concern.*

Historic reports of stinkpot at Acadia are few. Manville (1938,1939) reports it from Muck Swamp (Beaver Dam/Muck Pond), Bubble Pond and Echo Lake based on reports by Ranger

Louis Fowler. Manville did not personally observe the turtles, and no descriptions are given. Coman (1987) also reports the presence of stinkpot at Acadia, commenting that they are probably more numerous than the few observations would indicate. He also states "I have not seen one during the past five years". However, elsewhere Coman (1987) mentions 15 years of year round residency, plus seasonal residency going back to the 1940's. This implies that he has observed them there previously.

While vouchers and photos do not exist, based on the above accounts, and the fact that Acadia is within the known range of stinkpots, we have accepted stinkpot as having occurred historically. None were encountered in 2001 and there have been no recent records. However, considering it was probably rare to uncommon historically, it could still be present in low numbers or limited distribution. The amount of turtle trapping effort during this inventory was not sufficient to be certain it is absent. Trapping targeted specifically at this species would be necessary to provide a more definitive answer. Historically reported sites (i.e. Muck Swamp, Bubble Lake, and Echo Lake (Manville 1939)), and other similar sites would need to be funnel trapped intensively to clarify this species' status.

Snakes

Common Garter Snake (*Thamnophis sirtalis*; THSI)
The common garter snake occurs throughout most of the United States, from east coast to west and from Florida well into Canada (Ernst and Barbour 1989). It is the most abundant reptile in Maine (Hunter et al. 1999), occurring across a broad range of habitat conditions (Klemens 1993).

Patterns of abundance and habitat use by the common garter snake at Acadia conformed to that of this species in general. It was the most common snake at Acadia (138 encountered) and the second most common reptile (Table 1). Since it is an active and conspicuous species, it was the snake species most frequently recorded as incidental encounter or during time constrained search (Table 3b). It was the most widely distributed species in this inventory, recorded at 97 locations, with a frequency of occurrence of 0.35. The majority of these locations (74) were on Mount Desert Island, with 22 on Isle au Haut, and 1 on Bar Island (Table 2, Fig 21). Regardless of whether data are interpreted based on numbers of individuals (Table 1) or occurrences (Table 2), they show the common garter snake to be abundant and fairly equally distributed between wetland and upland habitats.

Snakes exhibiting characteristics of the eastern (*T. s. sirtalis*) and the maritime garter snake (*T. s. pallidulus*) were observed during the survey. Hunter et al. (1999) discusses the taxonomic status of these forms in Maine. The nominate form has three yellow to brown stripes down the back with two rows of alternating black spots between the stripes, whereas the maritime garter snake lacks the center stripe and has a pronounced lateral checkered pattern. Examples seen on Acadia were very variable in color and pattern and could not be reliably assigned to either subspecies. During 2001, Finn Pillsbury, a College of the Atlantic student, studied morphological differences in garter snakes on various coastal islands, including Isle au Haut. The results of that study may provide further insight into the taxonomic status of Acadia garter snakes.

Manville (1939) considered the garter snake to be the most common and widespread snake on Mount Desert Island, as did Coman (1987). It still appears to be so.

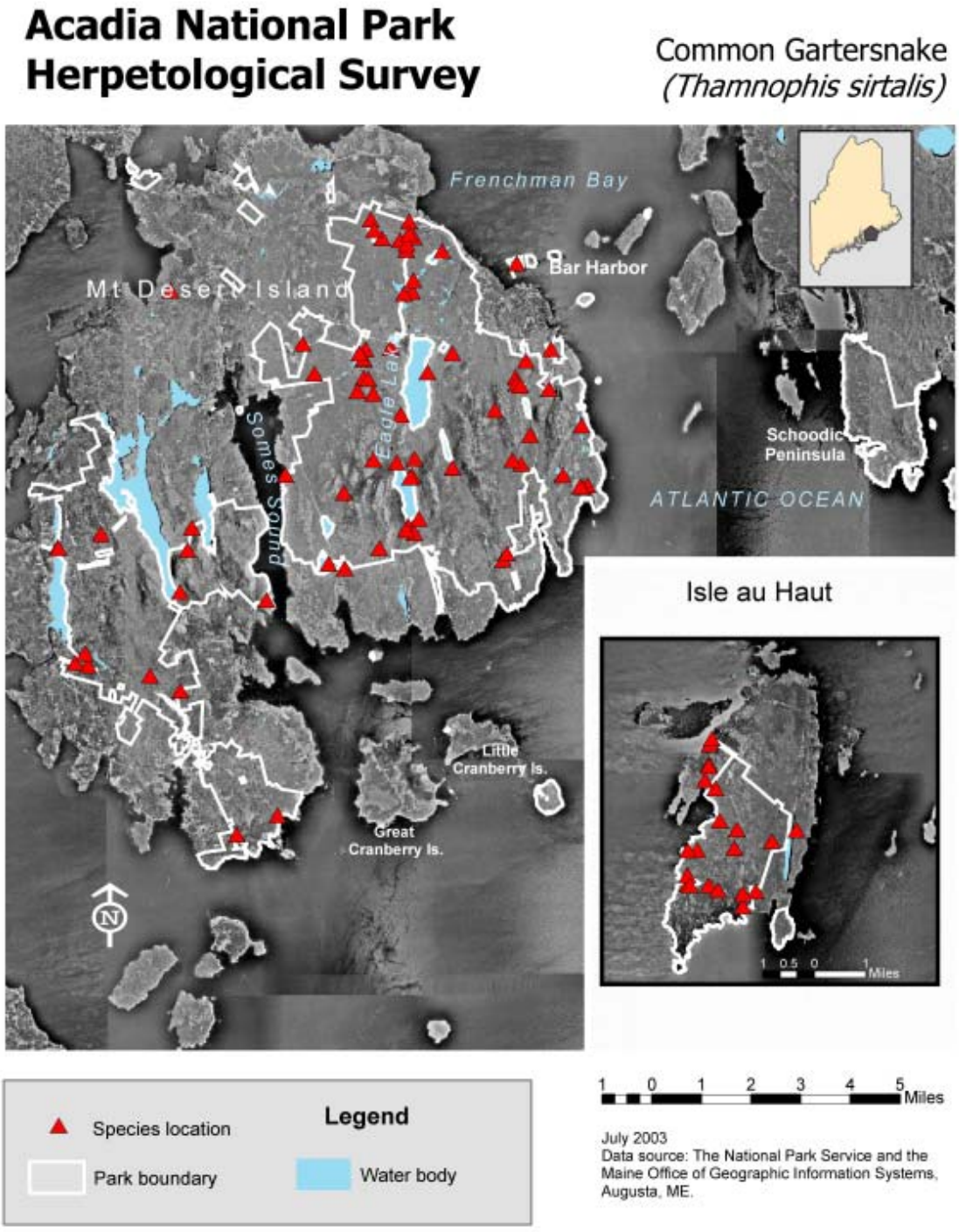


Figure 21. Map of Common Garter Snake found in Acadia National Park during herpetological inventory surveys in 2001.

Smooth Green Snake (*Opheodrys vernalis*; OPVE)
The smooth green snake occurs in the northern half of the eastern United States, extending into southern Canada (Ernst and Barbour 1989). In Maine, it occurs primarily in the open meadows and grassy habitats of southern and coastal Maine and appears to avoid the extensively forested areas in the northwestern region of the state (Hunter et al. 1999).

The smooth green snake was the second most common and widely distributed snake at Acadia. There were 47 encounters at 26 localities, most of which were in uplands or roads (Tables 1 and 2, Fig 22, Appendix 7a,b and 8a,b). The majority of green snake records were from Isle au Haut (Appendix 9). There, a 2.5 hour search of grassy meadows and roadsides on 7 August 2001 captured 13 individuals. Nine of these were captured near the Old Campground site in an open, tall grass field. Hunter et al. (1999) also noted the smooth green snake was common on many islands in Maine. As a cool-adapted species (Klemens 1993), it would have been able to re-colonize the post-glacial landscape before sea level rise created these coastal islands.

In New England, smooth green snakes are believed to have expanded in distribution and abundance in response to agricultural clearing during colonial times. More recently they have declined. Part of this decline is a return to their pre-colonial status, as woodlands returned following agricultural abandonment in the 19th century. However, pesticides, which affect them directly and by eliminating their arthropod prey, and habitat loss to urban and suburban development, are also factors in their decline (Klemens 1993). They remain common, however, in open coastal habitats. At Acadia, Manville (1939) considered them common, as did Coman (1987), and they still appear to be.

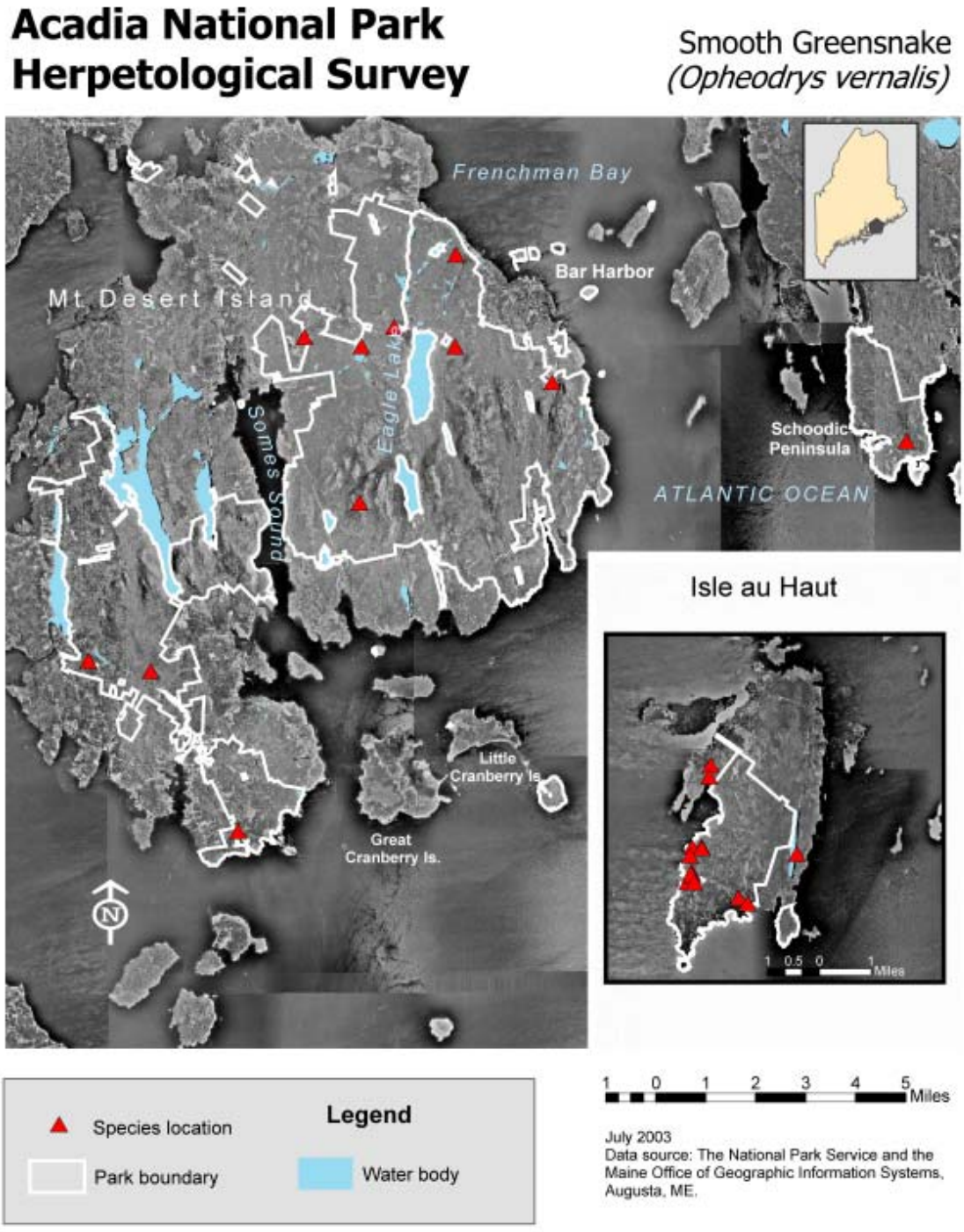


Figure 22. Map of Smooth Green Snake found in Acadia National Park during herpetological inventory surveys in 2001.

Northern Red-bellied Snake (*Storeria occipitomaculata occipitomaculata*; STOC)
The red-bellied snake (*S. occipitomaculata*) is widely distributed over most of the eastern U.S., extending north into southern Canada (Ernst and Barbour 1989), with most of that range occupied by the northern red-bellied snake (Klemens 1993). This secretive snake inhabits most all but extreme northern Maine, occurring predominantly in moist woodlands (Hunter et al. 1999). It is most commonly found under rocks, logs, and other cover.

At Acadia, the northern red-bellied snake pretty much conforms to the species' norm. It was moderately abundant, with 43 observations (Table 1), and widely distributed. It was recorded at 19 localities, 14 on Mount Desert Island, four on Isle au Haut, and one on Bar Island (Table 2, Fig 23). While it was recorded in wetlands, uplands, and on roads, the majority of individuals (26 of 43) were in uplands (Table 1, Appendix 7a,b and 8a,b). The "secretive" nature of northern red-bellied snake is seen in it being the most frequently captured species under coverboards, and coverboards being the primary means of recording this species (Tables 3b, 4, and 14). An atypical red-bellied snake was collected in the Western Mountain Road Wetland, a wooded, sphagnum wetland. Instead of the typical red or orange belly, the venter of this individual was slate gray/blue-black.

The historical account of Manville (1938, 1939) suggests the northern red-bellied snake was relatively common, and Coman (1987) considered it be also. Based on this inventory, it still appears to be common and widespread.

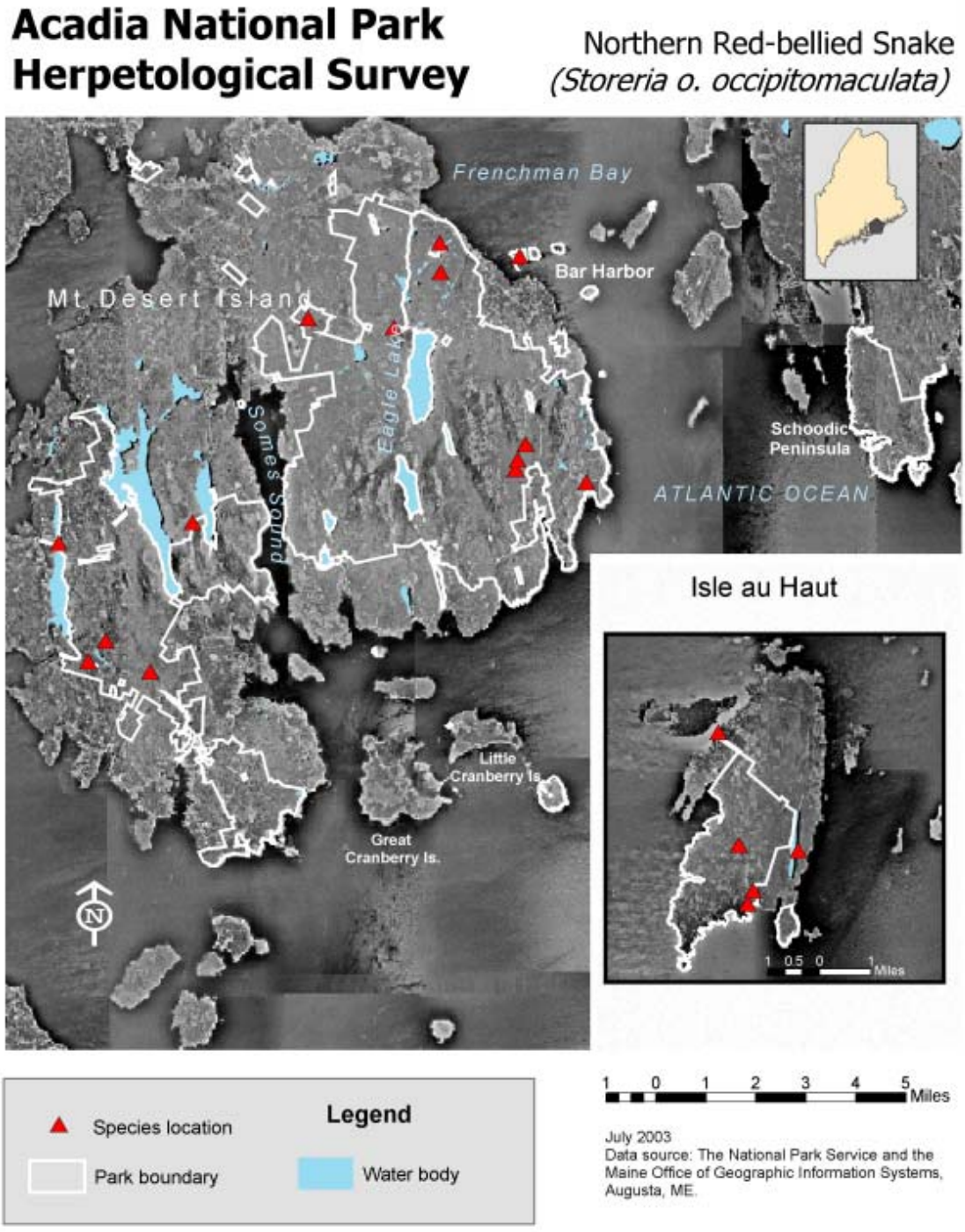


Figure 23. Map of Northern Red-bellied Snake found in Acadia National Park during herpetological inventory surveys in 2001.

Eastern Milk Snake (*Lampropeltis triangulum triangulum*; LATR)
The eastern milk snake ranges throughout most of the eastern United States and into southern Canada (Degraaf and Rudis 1983). In Maine, its distribution is limited to the southern region of the state (Hunter et al. 1999). The eastern milk snake is a secretive species that is most active at night during the summer months and found in habitats ranging from woods, meadows, bogs, and farmland (Conant and Collins 1991). This species is frequently associated with old farm fields and associated dilapidated structures, and trash piles, and thrives in human altered habitats (Klemens 1993). .

The eastern milk snake was moderately common, with 11 individuals recorded (Table 1, Fig 24). Only two were captured and measured (one under a coverboard at Seal Cove Road Homestead and the second as an incidental encounter at Cadillac Mountain Field) (Table 14, Appendix 9). The other nine were incidental encounters of adults that were not captured, dead snakes (two DOR), shed skins, or miscellaneous observations without specimen data (Table 3b). It was recorded at 11 localities on Mount Desert Island, six of which were while crossing roads, as well as in wetlands and uplands (Table 2, Appendix 7a,b and 8a,b).

Manville (1938, 1939) considered the eastern milk snake to be common at Acadia, and reports three specimens and eight observations, four of which were road kills, spanning a seven-year period. Coman (1987) notes that it is widely distributed over MDI, both geographically and ecologically. This inventory found comparable numbers, though it is difficult to compare sampling effort. While this species is likely more common in Acadia, and its population more secure, than the 2001 survey suggests, the loss of old agricultural fields through succession to woodlands may cause a population decline in the future.

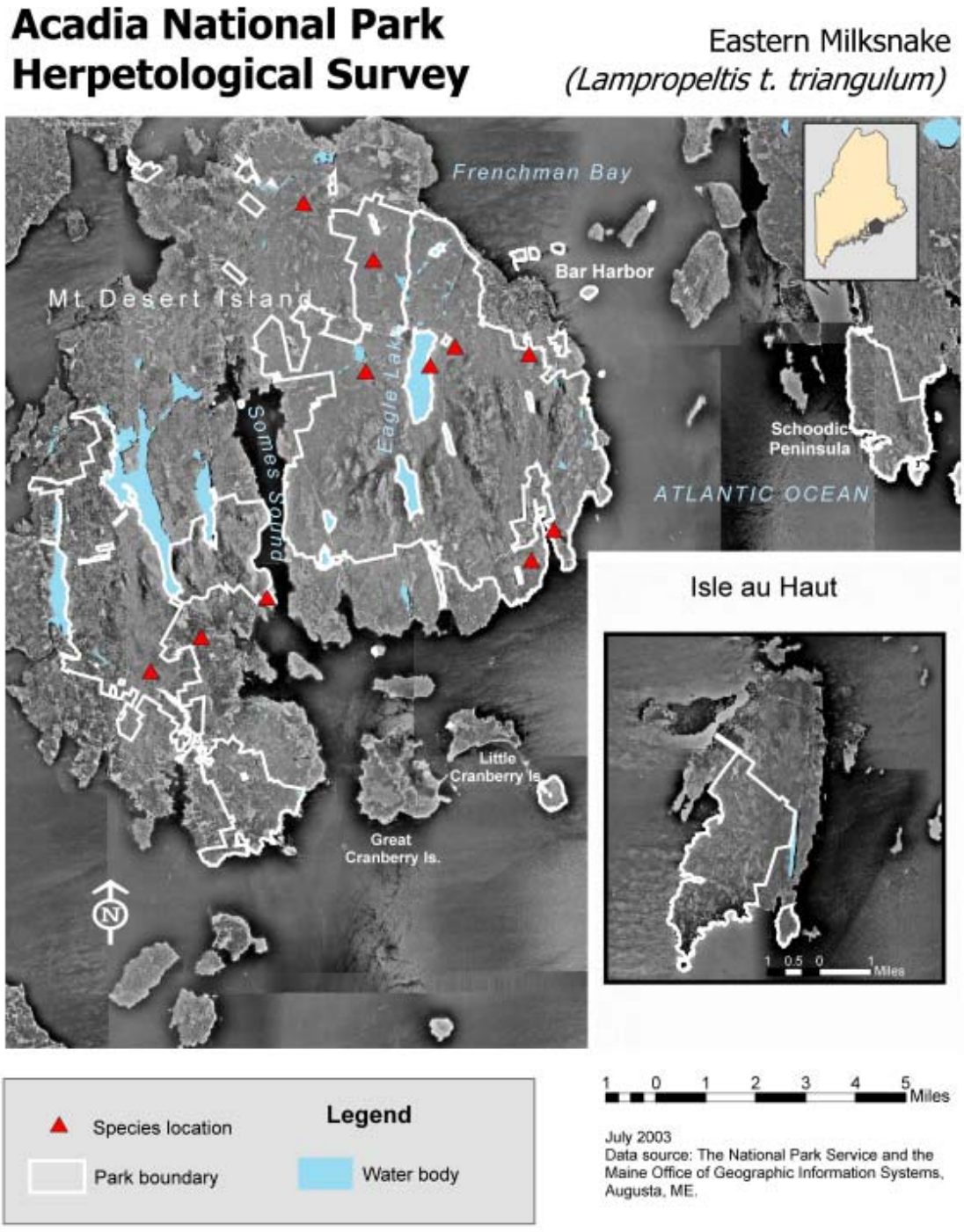


Figure 24. Map of Eastern Milk Snake found in Acadia National Park during herpetological inventory surveys in 2001.

Northern Ring-necked Snake (*Diadophis punctuatus edwardsii*; DIPU)
The northern ring-necked snake is common throughout the northeastern United States (Degraaf and Rudis 1983) and found in a wide diversity of habitats (Klemens 1993). It is widespread in Maine. The northern ring-necked snake is small, primarily nocturnal, and rarely seen moving about during the daylight hours. This secretive species is typically found in moist woodlands with abundant cover and thus potential habitat in Acadia is abundant.

The ring-necked snake was the least common species of snake at Acadia in 2001, with only five individuals recorded. Four were on Mount Desert Island and the other on Isle au Haut (Table 1, Fig 25). They occurred in wetlands, uplands, and on roads (Tables 1 and 2, Appendix 7a,b and 8a,b). Two individuals were captured and measured, one during a coverboard check at the Old Gravel Pit on Isle au Haut, and the second as an incidental encounter at Fawn Pond (Table 14, Appendix 9). The three remaining records were incidental encounters or found-dead observations (Table 20). The Isle au Haut capture was significant as it was the first documented record of this species for the island.

Manville (1938, 1939) considered the northern ring-necked snake to be occasional at Acadia, and reports three specimens and one observation, a road kill. Coman (1987) noted that they are reported less frequently than other snakes, but attributed this to secretive habits rather than low numbers. While this may account for some of this species' apparent scarcity, the northern red-bellied snake is also a species with retiring habitats, and it was found in much greater numbers. This suggests that northern ring-necked snakes at Acadia are uncommon now, and probably have been so since the reports of Manville (1938, 1939).

This very distinctive species may be more abundant on Isle au Haut than 2001 survey results show, as Ranger John Cousins has seen them periodically over the years (J. Cousins, pers. comm.).

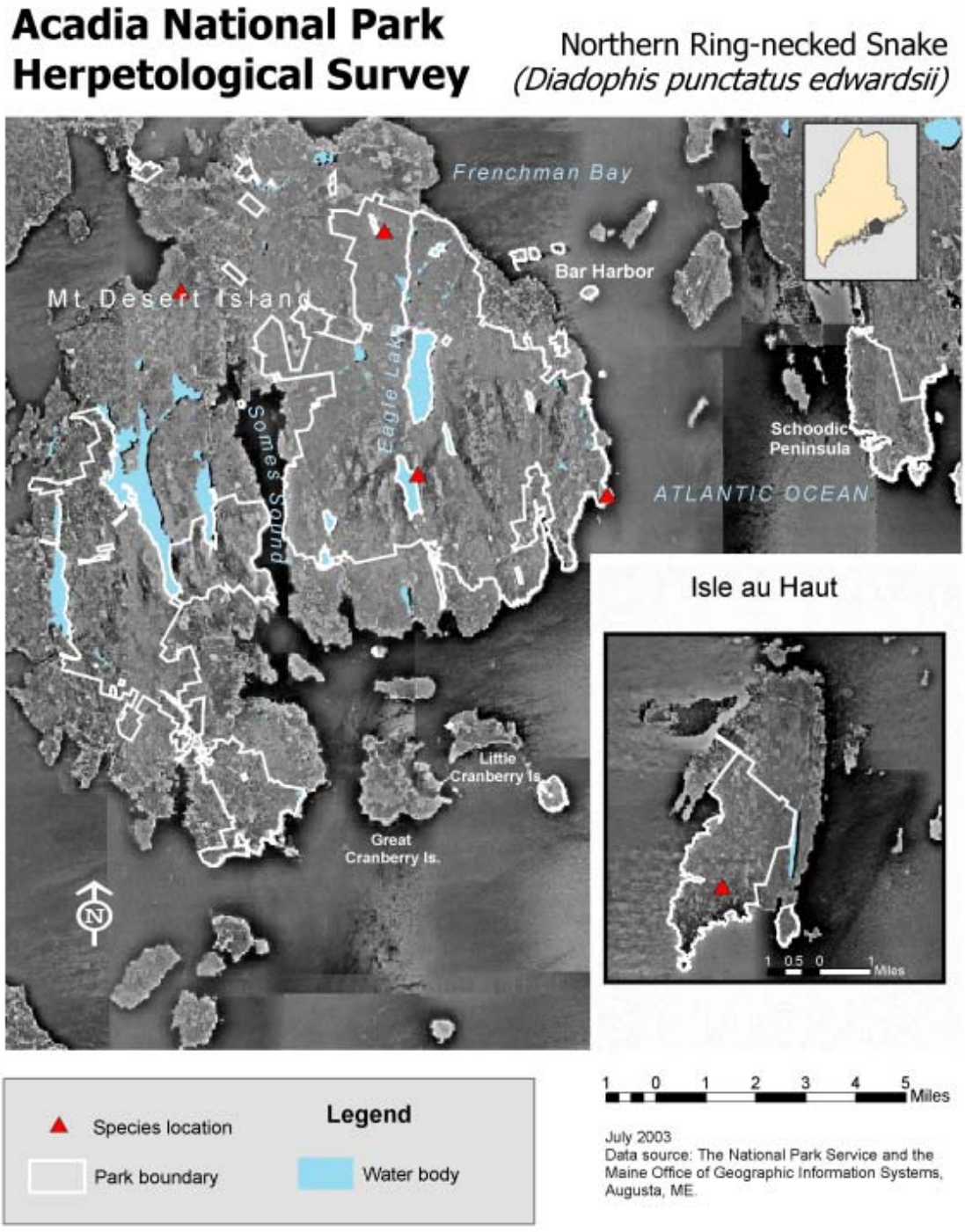


Figure 25. Map of Northern Ring-necked Snake found in Acadia National Park during herpetological inventory surveys in 2001.

Northern Black Racer (*Coluber constrictor constrictor*; COCO)
The northern black racer is common and widespread throughout the mid-Atlantic and north Atlantic states, extending into southern New England (Conant and Collins 1991). It avoids heavily forested habitats, preferring more open habitats (Klemens 1993). While the species (*C. constrictor*) ranges across most of the United States, and is common in many areas, its northern limit in New England is southern Maine. There it has declined, and the Maine Department of Inland Fisheries and Wildlife lists the northern black racer as *Endangered*. Northern black racers were once considered common as far north as Kennebec County by Fowler (1942), but there have been few reports of them in recent years. The only known populations of any size remaining in Maine occur in dry scrub forest habitat in Wells and Kennebunk in the southern tip of the state (Hunter et al. 1999).

Hugh McCrystal (1998), a competent field herpetologist, provides the only report of this species at Acadia. He saw two specimens during summer visits in 1973 and 1974. These were from Jordan Pond Trail, between Bar Harbor and Otter Creek. Given their large size (the racer is Maine's largest snake and adults may range from 0.9-1.8 m (3-6') in length) and their diurnal activity in open habitats, racers are conspicuous. Their presence is usually known to local naturalists. Yet, both Manville (1938) and Coman (1987) state that racers are not known to occur at Acadia. Acadia is at or just beyond the extreme limit of the black racer's known range in Maine. While racers apparently were absent in the 1930's and also by the 1980's, it is plausible that the individuals observed by McCrystal in the early 1970's were part of a failed colonization. Given their ongoing decline and range contraction in recent decades, additional colonization presumably did not follow. Thus, while the racer may have reached Acadia, it did not establish itself, and does not occur at Acadia.

Possible reasons for their decline in Maine include habitat loss and degradation as a consequence of development, human persecution, and elevated mortality from increasing vehicular traffic and predator populations. This species requires large tracts of intact habitat, and it travels relatively long distances while hunting. These movements expose it to hostile environments and a growing number of risks.

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Appendix 1. Amphibians and reptiles historically reported from Acadia National Park, based on literature and personal communications. Species codes are defined in Appendix 3. Species in bold are those believed to represent historically occurring wild populations. * Marine species.

Reference	Species																								
	AMMA	**BUAM**	**CHPI**	**CHSE**	COCO	**DECO***	**DEFU**	**DIPU**	EMBL	**EUBI**	GLIN	**HESC**	**HYVE**	**LATR**	**OPVE**	**NOVI**	**PLCI**	**PSCR**	**RACA**	**RACL**	**RAPA**	**RAPI**	**RASY**	**STOC**	**STOD**	**THSI**
Bishop, S. C.& N.T. Clarke.1923.	X														X						X			X		X
Burnley, J. M. & S. A Raha. 1971.								—							X					X	X					X
Coman D. R. 1987.	X	X		X			X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Davis, S. L. 1958.	X	X					X			X							X	X	X	X	X		X			
Davis, S. L. 1960.												X	X	X			X	X								
Favour, P.G. 1963	X	X	X	X			X		X	X	X				X	X	X	X	X	X	X	X	X			X
Glanz, W. E. & B. Connery. 1999.	X	—														X	X	X		X			X			
Manville, R. H. 1938.	X	X		X		X	X	X		X			X?	X	X	X	X	X	X	X	X	X	X	X	X?	X
Manville, R. H. 1939.	X	X		X			X	X		X			X?	X	X	X	X	X	X	X	X	X	X	X	X?	X
Manville, R. H. 1964.	X														X			X			X			X		X
McCrystal, H. 1988					X																					
Mittelhauser, G. H. 1995.																	X	X					X	X		

Appendix 1 Amphibians and reptiles historically reported from Acadia National Park, based on literature and personal communications. Species codes are defined in Appendix 3. Species in bold are those believed to represent historically occurring wild populations. * Marine species (continued).

Reference	Species																								
	AMMA	**BUAM**	**CHPI**	**CHSE**	COCO	**DECO**	**DEFU**	**DIPU**	EMBL	**EUBI**	GLIN	**HESC**	**HYVE**	**LATR**	**OPVE**	**NOVI**	**PLCI**	**PSCR**	**RACA**	**RACL**	**RAPA**	**RAPI**	**RASY**	**STOC**	**STOD**	**THSI**
Mittelhauser, G. H., J. H. Connery, & J. Jacobs. 1996															X		X									X
Rhodin, A. G. J. 1992.			X								X															
Russell, S. and B. Connery. 1997. The "Ribbet" Report –	X												X?					X		X	X	X?	X			
Stupka, A. 1933.								X	—						X									X		
White, H. B. 1974.																				X						
Zabinski-Gormley, N. & F.C. Olday. 1977.				X																						

Appendix 2. Habitat types and categories assigned to herpetological survey sites in Acadia National Park, 2001. Habitat Categories (HC) represent the five main groups the habitat types were grouped into.

HC	Habitat Type	Description
STREAMS	Permanent Stream	Narrow (<3m wide), flowing body of water with water flowing throughout the year.
	Intermittent Stream	Narrow (<3m wide), flowing body of water that dries up for a period of time during the year.
	Seep	Area where groundwater surfaces, creating a slow moving wet area; often found on slopes.
WETLANDS	Temporary Pond	Open or closed canopy body of water that holds water for part of the year, drying during late summer months, and is void of fish. Identified by water stained leaves and buttressed tree trunks (i.e. Pin Oak (*Quercus palustris*); Black Gum (*Nyssa sylvatica*)). Invertebrates present include fairy shrimp, predacious diving beetles, copepods, cladocerans, and caddisfly larvae.
	Permanent Pond	Open body of water (<2 ha), holds water the entire year, and fish are usually present. Borders of the pond are well defined.
	Beaver Pond	Open body of water, usually permanent, with active or previous evidence of beaver activity. Usually flowing body of water with a beaver dam creating a pond and/or marsh area.
	Marsh/Swamp	Body of water without well-defined borders, supporting abundant vegetation such as deciduous trees (i.e. Red Maple (*Acer rubrum*)), shrubs (i.e. Buttonbush (*Cephalanthus occidentalis*)), and emergent, herbaceous vegetation (i.e. Soft Rush (*Juncus effuses*); sedges (*Carex* spp.)). Water is usually shallow (<1m) and substrate mucky.
	Emergent Wetland	Closed canopy body of shallow water (<1m), dominated by erect, rooted, herbaceous aquatic plants (i.e. Soft Rush (*Juncus effusus*); Cattail (*Typha latifolia*)).
	Forested Wetland	Closed canopy body of shallow water (<1m), dominated by tall (>3m), woody vegetation (i.e. Red Maple (*Acer rubrum*); Pin Oak (*Quercus palustris*)).
	Bog/Heath	Sphagnum peat wetland, oftentimes "quaky" when walked on. Deep (>1m) in spots, supporting a unique plant community including blueberry and cranberry (*Vaccinium* spp.), Sundew (*Drosera rotundifolia*), and pitcher plants (*Sarracenia purpurea*).
	Lake	Open canopy, large (>2ha) body of water (>1m deep), with well-defined borders, surrounded by deciduous and/or coniferous forest. Fish present.
UPLANDS	Woodland	Forest dominated by deciduous/coniferous trees (i.e. oak (*Quercus* ssp.); maple (*Acer* spp.); pine (*Pinus* spp.); spruce (*Picea* spp.)).
	Field (grass/forbs)	Open canopy, upland area dominated by grasses and sedges. (i.e. *Poa* spp.; *Carex* spp.)
	Campground, Garden, House, Park	Altered, open canopy areas, often used by people.
ROADS	Road	Paved area, heavy car traffic.
	Carriage Road	Gravel roads meandering through the mountains and throughout the park, popular for hiking and biking.
	Driveway, Parking Area	Paved or dirt areas used by vehicles.
	Trail	Dirt pathway constructed through woodlands, fields, and along roads maintained for hiking.
TIDAL	Harbor	Rocky, exposed shoreline along the ocean.
	Tidal Marsh	Brackish wetland, located adjacent to the ocean, influenced by tidewater.
	Tide Pool	Small pond (<1ha), adjacent to the ocean in exposed rocky areas. Infuenced by tidewater.

Appendix 3. Code, common name, and scientific name of amphibian and reptile species historically reported from Acadia National Park. Common and scientific names and spellings are from Crother (2000).

Code	Common Name	Scientific Name
AMMA	Spotted Salamander	*Ambystoma maculatum*
BUAM	American Toad	*Bufo a. americanus*
CHSE	Snapping Turtle	*Chelydra serpentina*
CHPI	Painted Turtle	*Chrysemys picta*
GLIN	Wood Turtle	*Glyptemys insculpta*
COCO	Northern Black Racer	*Coluber c. constrictor*
DECO	Leatherback Seaturtle	*Dermochelys coriacea*
DEFU	Northern Dusky Salamander	*Desmognathus fuscus*
DIPU	Northern Ring-necked Snake	*Diadophis punctuatus edwardsii*
EMBL	Blanding's Turtle	*Emydoidea blandingii*
EUBI	Northern Two-lined Salamander	*Eurycea bislineata*
HESC	Four-toed Salamander	*Hemidactylium scutatum*
HYVE	Gray Treefrog	*Hyla versicolor*
LATR	Eastern Milk Snake	*Lampropeltis t. triangulum*
NOVI	Red-spotted Newt	*Notophthalmus v. viridescens*
OPVE	Smooth Green Snake	*Opheodrys vernalis*
PLCI	Eastern Red-backed Salamander	*Plethodon cinereus*
PSCR	Spring Peeper	*Pseudacris crucifer*
RACA	American Bullfrog	*Rana catesbeiana*
RACL	Northern Green Frog	*Rana clamitans melanota*
RAPA	Pickerel Frog	*Rana palustris*
RAPI	Northern Leopard Frog	*Rana pipiens*
RASY	Wood Frog	*Rana sylvatica*
STOC	Northern Red-bellied Snake	*Storeria o. occipitomaculata*
STOD	Stinkpot	*Sternothorus odoratus*
THSI	Common Garter Snake	*Thamnophis sirtalis*

Appendix 4. Search effort, area or distance surveyed, and GPS coordinates for 39 time-constrained survey sites in Acadia National Park from 2 May to 4 September 2001. The Global Positioning System (GPS) position is presented as Universal Transverse Mercator (UTM) grid coordinates X=x-axis or East, and Y=y-axis or North.

Site	# of Surveys	Search Effort (person hrs.)	Area or Distance	GPS Coordinates			
				UTMX	UTMY	UTMX	UTMY
Wetlands							
Duck Pond	2	2.9	9275m^2	549475	4907626	549415	4907608
				549458	4907344	549475	4907355
				549497	4907782	549439	4907578
Dudley Pond	1	0.3	1219 m^2	565360	4910290	565332	4910283
				565394	4910248	565403	4910267
Eagle Lake SE Marsh	1	1.4	3396 m^2	560181	4911447	561069	4911518
				560217	4911446	560222	4911527
Echo Lake Wetland	1	2.8	7193 m^2	552992	4907090	552989	4906580
				553019	4906885		
Gilmore Meadow	1	2.8	15495 m^2	557959	4912641	557948	4912519
				558032	4912706	558109	4912606
Great Meadow	1	3.4	151500 m^2	562984	4912576	562836	4913030
				562953	4913327	563231	4913235
Half Moon Pond	1	1.2	154 m	559725	4915527	559624	4915643
Heath Brook Wetland	2	1.6	4068 m^2	550416	4902931	550287	4903010
				550434	4902936	550371	4903009
Hodgdon Pond / Field	1	2.0	4589 m^2	548080	4907138	548049	4907129
				548086	4907319	548107	4907349
Jordan Stream Wetland	1	0.8	4538 m^2	559782	4908089	559797	4908087
				559838	4907944	559785	4907956
Long Pond Fire Rd. Wetland	1	0.3	1611 m^2	548605	4906969	548639	4906961
				548655	4907052		
Long Pond Fire Road	1	1.1	6931 m^2	549848	4908712	550098	4908193
				550079	4908177		
North Jordan Pond Beaver Wetland	1	0.6	1080 m^2	559066	4909923	559107	4909938
				559084	4909964	559053	4909935
Sand Beach Field / Marsh	1	4.6	23723 m^2	565118	4908789	565262	4908793
				565195	4908884	565073	4909176
Schooner Head Wetland	1	1.2	18211 m^2	564990	4911448	564938	4911465
				565041	4911217	564964	4911157
Seal Cove Pond NE Shore	1	0.7	684 m	548052	4906965	548199	4906297
Seal Cove Pond South	1	1.0	1340 m^2	548470	4904502	548407	4904264
				548373	4904185	548338	4904064
Two Moose Pond	1	1.3	17157 m^2	551843	4901518	551944	4901534
				551959	4901340	551935	4901252
Western Mt. Rd. Wetland	2	2.2	1474 m^2	549598	4903983	549562	4903922
				549505	4903969	549555	4904018
				549598	4903983	549505	4903969
				549562	4903922	549555	4904018
Witch Hole Pond	1	2.1	28805 m^2	560207	4916782	560001	4916475
				560114	4916423	560014	4916361
Total Search Effort in Wetlands		**34.3**					

Appendix 4. Search effort, area or distance surveyed, and GPS coordinates for 39 time-constrained survey sites in Acadia National Park from 2 May to 4 September 2001. The Global Positioning System (GPS) position is presented as Universal Transverse Mercator (UTM) grid coordinates X=x-axis or East, and Y=y-axis or North (continued).

Site	# of Surveys	Search Effort (person hrs.)	Area or Distance	GPS Location			
				UTMX	UTMY	UTMX	UTMY
Streams							
Duck Pond Stream North	1	1.8	76 m	549673	4908870	549598	4908882
Duck Pond Stream South	1	0.6	81 m	549461	4907922	549453	4907841
Gorge Trail Stream	1	1.1	29 m	561963	4913583	561984	4913563
Hadlock Stream	1	3.0	54 m	556694	4907078	556747	4907087
Heath Brook	1	2.3	70 m	550546	4902780	550502	4902835
Isle au Haut Stream Site #2	1	0.8	178 m	528299	4875264	528386	4875109
Isle au Haut Stream Site #5	1	1.6	80 m	529741	4874892	529678	4874842
Lurvey Brook	1	0.5	186 m	551309	4902916	551197	4903064
Richardson's Brook Site #1	1	0.7	63 m	555888	4912783	555950	4912773
Richardson's Brook Site #2	1	0.7	148 m	556571	4912434	556713	4912475
Total Search Effort in Streams		**13.1**					
Woodlands							
Jordan Pond Trail North	1	0.6	660 m	559505	4909431	559066	4909923
Long Pond Trail	2	2.2	1817 m	551821	4905407	551187	4907110
Seal Cove Rd. Woods	1	0.7	5596 m^2	550571	4902907	550593	4902824
				550535	4902795	550522	4902914
Seal Cove Rd. Woods (west)	1	1.8	2040 m^2	548638	4903416	548621	4903411
				548707	4903361	548645	4903422
South Tarn Trail	1	1.7	1100 m	563397	4910814	562884	4909841
Western Mt. Rd. Woods	1	1.8	838 m^2	550521	4903554	550467	4903563
				550529	4903508	550455	4903657
Western Trail	1	0.6	1082 m	548655	4907052	549713	4906825
Total Search Effort in Woodlands		**9.4**					
Fields							
Carroll Homestead	1	1.0	4101 m^2	553711	4905849	553730	4905865
				553817	4905774	553786	4905748
Sargent Drive Picnic Area	3	2.2	7852 m^2	555450	4909519	555539	4909399
				555525	4909368	555435	4909399
Total Search Effort in Fields		**3.2**					

Appendix 5. Coverboard array board numbers and GPS positions of coverboard survey sites in Acadia National Park, 2001. The Global Positioning System (GPS) position is presented as Universal Transverse Mercator (UTM) grid coordinates X=x-axis or East, and Y=y-axis or North.

Coverboard Site	Board #'s	GPS Position			
		UTM X	UTM Y	UTM X	UTM Y
Bar Island Field	65-68	562937	4916374	562961	4916396
	69-72	563045	4916461	563066	4916438
	73-76	563057	4916360	563077	4916337
Beech Hill Road Field	77-84	552413	4907800	552428	4907774
Blackwoods Field	101-108	562501	4906753	562466	4906746
Cadillac Mountain Field	33-40	560890	4913501	560830	4913529
	109-112	560886	4913495	560875	4913468
	113-116	560896	4913522	560861	4913533
Fernald Point Field	41-48	554831	4905449	554856	4905510
Hodgdon Pond Field	49-56	554831	4905449	554911	4905423
Isle au Haut—Merchants Cove Field	131-132	529668	4874360	-	-
Isle au Haut--Old Campground Field	125-126	527915	4875340	-	-
Isle au Haut – Old Cemetery	133	528578	4875024	-	-
Isle au Haut--Old Gravel Pit	129	528869	4874898	-	-
Isle au Haut--Shark Point Beach Field	122-123	527929	4876121	-	-
Isle au Haut--Shark Point South Field	124	527863	4875858	-	-
Isle au Haut—Western Head Field	127-128	527996	4875021	-	-
Kebo Street Field	1-5	562703	4913424	562706	4913455
	6-12	562706	4913455	562655	4913500
Mars Field	13-20	558844	4914147	558904	4914102
	21-24	558904	4914102	558934	4914062
Sand Beach Field Back	25-32	565259	4909187	565335	4909169
Sand Beach House Field Front	93-96	565133	4909094	565124	4909111
	97-100	565107	4909105	565125	4909081
Seal Cove Road Site 1 Field	57-64	549013	4903321	549053	4903313
Seal Cove Road Homestead Field	85-88	551057	4902964	551050	4902991
	90-92	551060	4902979	551037	4902958

Appendix 6. Coordinates for GPS points depicted on Figure 2 (drift fence array at Sunken Heath). The Global Positioning System (GPS) position is presented as Universal Transverse Mercator (UTM) grid coordinates X=x-axis or East, and Y=y-axis or North.

GPS Point	GPS Position	
	UTMX	UTMY
1	556119	4914360
2	556115	4914380
3	556131	4914385
4	556108	4914402
5	556138	4914444
6	556174	4914385
7	556191	4914392
8	556204	4914374
9	556198	4914408

Appendix 7a. Habitat type, surveys conducted, and GPS positions for 120 standardized surveys sites in Acadia National Park, 2001. Survey methods are: ACC=Anuran Call Count; EMC=Egg-Mass Count; TCS=Time-Constrained Search; CB=Coverboard; TT=Turtle Trap; MT=Minnow Trap; DF=Drift Fence; IE=Incidental Encounter (Incidental encounters at standard survey sites included here). The Global Positioning System (GPS) position is presented as Universal Transverse Mercator (UTM) grid coordinates X=x-axis or East, and Y=y-axis or North.

Site Name	Habitat	Survey Method	GPS Position	
			UTM X	UTM Y
Aunt Betty Pond	permanent pond	ACC,IE	557983	4913262
Bar Island Fields	field	CB,IE	562961	4916396
Bass Harbor Marsh	marsh	ACC,IE	551580	4902237
Beaver Dam / Muck Pond	permanent pond	ACC, IE,TT	564011	4912316
Beech Hill Road Field	field	CB	552413	4907800
Big Heath Pond	heath/ bog	ACC,EMC,IE,MT	554262	4898275
Blackwood's Field	field	CB	562501	4906753
Blackwood's Wetland	pond/marsh	ACC,IE	562733	4905857
Brewer Mountain Marsh	pond/marsh	ACC,IE	559371	4914360
Bubble Pond	pond	ACC,EMC,IE	560496	4910952
Cadillac Mountain Field	field	CB,IE	560875	4913468
Carroll Homestead	field	TCS	553711	4905849
Duck Brook Road	road	ACC,IE	560319	4914500
Duck Brook Road Bridge Pond	temporary pond	ACC	561388	4915585
Duck Brook Road Marsh	marsh	ACC	560748	4915618
Duck Brook Road Pond	pond	ACC	560866	4915494
Duck Pond	permanent pond/bog	ACC,EMC,IE,MT,TCS,TT	549463	4907594
Duck Pond Stream North	permanent stream	TCS	549673	4908870
Duck Pond Stream South	intermittent stream	IE,TCS	549461	4907922
Dudley Pond	pond	ACC,EMC,IE,TCS	565396	4910261
Eagle Lake Pond	pond	TT	559629	4914070
Eagle Lake SE Marsh	marsh	ACC, IE,TCS	560212	4911439
East Marsh	marsh	ACC,IE	560561	4916834
Echo Lake Wetland	marsh	ACC,TCS	552941	4906963
Entrance Station Pond	beaver pond	EMC,IE	564937	4910391
Fawn Pond	permanent pond	IE,MT,TT	558588	4917211
Fernald Point Field	Field	CB	554831	4905449
Geronimo Pond	permanent pond	ACC,IE,MT, TT	559388	4917026
Gilmore Meadow	pond/marsh	ACC,IE,TCS	557988	4912673
Gorge Trail Stream	stream	TCS	561963	4913583
Great Meadow	marsh	ACC,IE,TCS	563257	4913226
Hadlock Stream	intermittent stream	IE,TCS	556694	4907078
Half Moon Pond	pond	ACC,IE,TCS	559559	4915470
Halfway Marsh[2]	pond/marsh	ACC	559788	4916049
Heath Brook	stream	IE,TCS	550546	4902780
Heath Brook Wetland	marsh	ACC,IE,MT,TCS	550424	4902930
Hio Road Wetland	marsh	ACC	552676	4900225

Appendix 7a. Habitat type, surveys conducted, and GPS positions for 120 standardized surveys sites in Acadia National Park, 2001. Survey methods are: ACC=Anuran Call Count; EMC=Egg-Mass Count; TCS=Time-Constrained Search; CB=Coverboard; TT=Turtle Trap; MT=Minnow Trap; DF=Drift Fence; IE=Incidental Encounter (Incidental encounters at standard survey sites included here). The Global Positioning System (GPS) position is presented as Universal Transverse Mercator (UTM) grid coordinates X=x-axis or East, and Y=y-axis or North (continued).

Site Name	Habitat	Survey Method	GPS Position	
			UTM X	UTM Y
Hodgdon Pond	pond	ACC,IE	548064	4907171
Hodgdon Pond Field	field/marsh	CB,TCS	548080	4907138
Hodgdon Road Pond	pond/marsh	ACC,IE	547508	4907187
Isle au Haut – Bog on Road[2]	bog/wetland meadow	ACC	529311	4876456
Isle au Haut - Merchants Cove	field	CB,IE	529668	4874360
Isle au Haut - Old Campground Field	field	CB,IE	527915	4875340
Isle au Haut - Old Cemetery	field	CB,IE	528578	4875024
Isle au Haut - Old Gravel Pit	woodland	CB	528869	4874898
Isle au Haut – Shark Point Beach Field	field	CB,IE	527929	4876121
Isle au Haut - Western Head Field	field	CB,IE	527996	4875021
Isle au Haut Long Pond*	permanent pond/lake	IE,TT	530988	4875232
Isle au Haut Pond site 1	temporary pond	EMC,IE,MT	529387	4876189
Isle au Haut Pond site 3	temporary pond	EMC,IE	528873	4874878
Isle au Haut Pond site 6	pond	EMC,IE	530061	4874837
Isle au Haut Shark Point South Field	field	CB	527863	4875858
Isle au Haut Stream site 2	permanent stream	TCS	528299	4875264
Isle au Haut Stream site 5	permanent stream	TCS	529741	4874892
Jordan Pond	permanent pond/lake	ACC	559922	4907830
Jordan Pond Trail North	trail	TCS	559505	4909431
Jordan Stream Wetland	wetland	IE,TCS	559782	4908089
Kebo Street Field	field	CB	562706	4913455
Little Precipice Beaver Pond	beaver pond	EMC	564770	4911080
Little Turtle Pond	beaver pond	ACC,EMC,IE,MT,TT	559754	4914121
Long Pond	permanent pond/lake	IE,TT	550090	4908294
Long Pond Fire Road	road	IE,TCS	548970	4907340
Long Pond Fire Road Wetland	forested wetland	TCS	548605	4906969
Long Pond Fire Road Wetland #1	pond	ACC	549211	4909033
Long Pond Fire Road Wetland #2	alder swamp	ACC	547985	4909040
Long Pond Trail	trail	IE,TCS	552020	4905715

Appendix 7a. Habitat type, surveys conducted, and GPS positions for 120 standardized surveys sites in Acadia National Park, 2001. Survey methods are: ACC=Anuran Call Count; EMC=Egg-Mass Count; TCS=Time-Constrained Search; CB=Coverboard; TT=Turtle Trap; MT=Minnow Trap; DF=Drift Fence; IE=Incidental Encounter (Incidental encounters at standard survey sites included here). The Global Positioning System (GPS) position is presented as Universal Transverse Mercator (UTM) grid coordinates X=x-axis or East, and Y=y-axis or North (continued).

Site Name	Habitat	Survey Method	GPS Position	
			UTM X	UTM Y
Lower Hadlock Pond	permanent pond/lake	ACC,IE	556851	4906629
Lower Precipice Beaver Pond	beaver pond	EMC, IE	564961	4910589
Lurvey Brook	intermittent stream	TCS	551309	4902916
MARS	field	IE,CB	558904	4914102
Mill Reservoir	pond	ACC,IE	550776	4905053
New Mill Meadow	bog/wetland meadow	IE,MT	560705	4915471
North Breakneck Pond	pond	ACC,EMC,IE,MT,TT	559295	4915407
North Jordan Pond Beaver Wetland	wetland	TCS	559066	4909923
Northeast Creek	tidal marsh	IE,TT	555913	4918637
Oak Hill Road Wetland	marsh	ACC	551648	4912671
Owen's Stone Barn	field/barn	ACC,IE	555984	4918101
Park Loop Road Site #1	road	ACC	564372	4906339
Park Loop Road Site #2	road	ACC	560236	4906870
Park Loop Road Site #3	road	ACC	559875	4907170
Richardson's Brook Site #1	permanent stream	TCS	555888	4912783
Richardson's Brook Site #2	permanent stream	TCS	556571	4912434
Round Pond	pond	ACC	549867	4910843
Route 102 just west of Ripples Pond	road	ACC	550760	4911510
Sand Beach Field Back	field	CB	565259	4909187
Sand Beach Field Front	field	CB	565107	4909105
Sand Beach Field/ Marsh	field	TCS	565024	4909139
Sand Beach Wetland	pond/ marsh	ACC	565045	4909161
Sargent Drive Picnic Area	park	TCS	555450	4909519
Schooner Head Wetland	pond/marsh	ACC,EMC,IE,MT,TCS	565162	4911100
Seal Cove Coverboard Wetland	pond	ACC,EMC,IE	549100	4903227
Seal Cove Pond	pond	ACC	548458	4904518
Seal Cove Pond NE Shore	emergent wetland	IE,TCS	548052	4906965
Seal Cove Pond South Marsh	emergent wetland	IE,TCS	548470	4904502
Seal Cove Road Field Site 1	field	CB,IE	549039	4903324
Seal Cove Road Homestead Field	field	CB,IE	551050	4902991
Seal Cove Road Pond	permanent pond	EMC,IE	548309	4903443
Seal Cove Road Woods	woodland	TCS	550571	4902907

Appendix 7a. Habitat type, surveys conducted, and GPS positions for 120 standardized surveys sites in Acadia National Park, 2001. Survey methods are: ACC=Anuran Call Count; EMC=Egg-Mass Count; TCS=Time-Constrained Search; CB=Coverboard; TT=Turtle Trap; MT=Minnow Trap; DF=Drift Fence; IE=Incidental Encounter (Incidental encounters at standard survey sites included here). The Global Positioning System (GPS) position is presented as Universal Transverse Mercator (UTM) grid coordinates X=x-axis or East, and Y=y-axis or North (continued).

Site Name	Habitat	Survey Method	GPS Position	
			UTM X	UTM Y
Seal Cove Road Woods (west)	woodland	IE,TCS	548621	4903411
Seawall Pond	permanent pond	ACC,EMC,IE,MT	555194	4898451
Seawall Pond #2	permanent pond	ACC	555277	4898442
Somes Pond Wetland	pond	ACC,IE	551932	4911715
South Breakneck Pond	pond	ACC,IE	559339	4915135
South Tarn Trail	trail	TCS	563397	4910814
Southeast of the Bowl/Kief Pond[2]	marsh	ACC	564628	4908979
Sunken Heath	bog/heath	ACC,DF,IE, MT	556131	4914385
Sunken Heath Vernal Pond	temporary pond	EMC,IE	555926	4914420
The Bowl	perm. pond	ACC,IE	564458	4909513
The Tarn	marsh	ACC,IE	563375	4910882
Two Moose Pond	pond/marsh	IE,TCS	551929	4901338
Upper Hadlock Pond	permanent pond/lake	ACC,IE,TT	556648	4908146
Upper Precipice Beaver Pond	beaver pond	ACC,EMC	564866	4910552
Valley Cove Pond	permanent pond	ACC	554469	4905338
Western Mountain Road Wetland	forested wetland	TCS	549598	4903983
Western Mountain Road Woods	woodland	TCS	550521	4903554
Western Mountain/Lurvey Pond	pond	ACC	550423	4902925
Western Trail	trail	IE,TCS	548995	4906899
Wetland after Halfway Marsh[2]	wetland	ACC	559607	4915827
Wetland past East Marsh[2]	wetland	ACC	560842	4916465
Witch Hole Pond	pond	ACC,TCS	560561	4916834

Appendix 7b. Species recorded at each of 120 standardized surveys sites in Acadia National Park, 2001. Ranid species (RASP) represents unknown anuran larvae. Frequency of Occurrence is number of sites a species was recorded from, divided by total number of sites (120). Species codes are defined in Appendix 3.

Site Name	AMMA	BUAM	CHPI	CHSE	DIPU	EUBI	HESC	LATR	OPVE	NOVI	PLCI	PSCR	RACA	RACL	RAPA	RASP	RASY	STOC	THSI	# Spp.[1]
Aunt Betty Pond			X									X	X	X	X				X	6
Bar Island Fields																		X	X	2
Bass Harbor Marsh		X										X		X	X		X			5
Beaver Dam / Muck Pond	X		X	X					X			X		X	X				X	8
Beech Hill Road Field																		X	X	2
Big Heath Pond	X											X		X			X			4
Blackwood's Field																			X	1
Blackwood's Wetland	X											X								2
Brewer Mountain Marsh			X										X	X						3
Bubble Pond	X																			1
Cadillac Mountain Field								X	X										X	3
Carroll Homestead																				0
Duck Brook Road	X			X			X				X	X			X		X			7
Duck Brook Road Bridge Pond																				0
Duck Brook Road Marsh												X								1
Duck Brook Road Pond													X	X						2
Duck Pond	X		X	X						X		X	X*	X	X	X			X	9
Duck Pond Stream North											X				X					2
Duck Pond Stream South	X													X						2
Dudley Pond	X									X		X		X	X	X				5
Eagle Lake Pond																				0
Eagle Lake SE Marsh	X											X		X	X					4
East Marsh			X										X	X		X				3
Echo Lake Wetland											X	X			X					3
Entrance Station Pond	X													X						2

Appendix 7b. Species recorded at each of 120 standardized surveys sites in Acadia National Park, 2001. Ranid species (RASP) represents unknown anuran larvae. Frequency of Occurrence is number of sites a species was recorded from, divided by total number of sites (120). Species codes are defined in Appendix 3 (continued).

Site Name	AMMA	BUAM	CHPI	CHSE	DIPU	EUBI	HESC	LATR	OPVE	NOVI	PLCI	PSCR	RACA	RACL	RAPA	RASP	RASY	STOC	THSI	# Spp.[1]
Fawn Pond			X	X	X		X						X	X	X				X	8
Fernald Point Field																			X	1
Geronimo Pond			X	X								X	X	X	X		X		X	8
Gilmore Meadow								X				X	X	X	X	X			X	6
Gorge Trail Stream						X														1
Great Meadow	X							X				X	X	X	X	X	X		X	8
Hadlock Stream	X					X				X				X	X					5
Half Moon Pond							X				X	X	X	X	X	X			X	7
Halfway Marsh														X						1
Heath Brook						X									X					2
Heath Brook Wetland	X			X						X		X		X	X	X				6
Hio Road Wetland		X										X								2
Hodgdon Pond	X		X	X								X	X	X	X				X	8
Hodgdon Pond Field													X			X		X	X	3
Hodgdon Road Pond		X	X									X		X						4
Isle au Haut – Bog on Road												X								1
Isle au Haut - Merchants Cove									X									X	X	3
Isle au Haut - Old Campground Field									X										X	2
Isle au Haut - Old Cemetery																			X	1
Isle au Haut - Old Gravel Pit					X															1
Isle au Haut – Shark Point Beach Field									X										X	2
Isle au Haut - Western Head Field									X										X	2
Isle au Haut Long Pond*										X										1
Isle au Haut Pond site 1	X																X	X	X	4
Isle au Haut Pond site 3	X																X		X	3

Appendix 7b. Species recorded at each of 120 standardized surveys sites in Acadia National Park, 2001. Ranid species (RASP) represents unknown anuran larvae. Frequency of Occurrence is number of sites a species was recorded from, divided by total number of sites (120). Species codes are defined in Appendix 3 (continued).

Site Name	AMMA	BUAM	CHPI	CHSE	DIPU	EUBI	HESC	LATR	OPVE	NOVI	PLCI	PSCR	RACA	RACL	RAPA	RASP	RASY	STOC	THSI	# Spp.[1]
Isle au Haut Pond site 6	X															X	X		X	3
Isle au Haut Shark Point South Field																				0
Isle au Haut Stream site 2																				0
Isle au Haut Stream site 5											X									1
Jordan Pond												X								1
Jordan Pond Trail North															X				X	2
Jordan Stream Wetland													X	X		X			X	3
Kebo Street Field																				0
Little Precipice Beaver Pond	X																			1
Little Turtle Pond	X		X	X						X		X	X	X	X	X				8
Long Pond				X											X					2
Long Pond Fire Road	X										X			X						3
Long Pond Fire Road Wetland																				0
Long Pond Fire Road Wetland #1												X								1
Long Pond Fire Road Wetland #2												X			X					2
Long Pond Trail												X							X	2
Lower Hadlock Pond													X						X	2
Lower Precipice Beaver Pond	X			X																2
Lurvey Brook											X			X		X				2
MARS									X									X		2
Mill Reservoir	X					X									X					3
New Mill Meadow	X									X			X	X			X			5
North Breakneck Pond	X		X	X						X	X	X	X	X	X	X			X	10

Appendix 7b. Species recorded at each of 120 standardized surveys sites in Acadia National Park, 2001. Ranid species (RASP) represents unknown anuran larvae. Frequency of Occurrence is number of sites a species was recorded from, divided by total number of sites (120). Species codes are defined in Appendix 3 (continued).

Site Name	AMMA	BUAM	CHPI	CHSE	DIPU	EUBI	HESC	LATR	OPVE	NOVI	PLCI	PSCR	RACA	RACL	RAPA	RASP	RASY	STOC	THSI	# Spp.[1]
North Jordan Pond Beaver Wetland													X	X		X			X	3
Northeast Creek			X	X								X	X	X						5
Oak Hill Road Wetland												X			X					2
Owen's Stone Barn								X				X					X			3
Park Loop Road Site #1												X								1
Park Loop Road Site #2												X								1
Park Loop Road Site #3												X								1
Richardson's Brook Site #1						X														1
Richardson's Brook Site #2						X				X	X									3
Round Pond												X			X					2
Route 102 just west of Ripples Pond												X			X					2
Sand Beach Field Back																			X	1
Sand Beach Field Front																		X	X	2
Sand Beach Field/ Marsh														X					X	2
Sand Beach Wetland												X	X	X	X					4
Sargent Drive Picnic Area											X								X	2
Schooner Head Wetland	X									X		X	X	X	X	X	X		X	8
Seal Cove Coverboard Wetland		X									X	X		X		X	X			5
Seal Cove Pond												X		X	X					3
Seal Cove Pond NE Shore											X	X	X		X					4
Seal Cove Pond South Marsh												X	X		X					3
Seal Cove Road Field Site 1									X			X						X	X	4
Seal Cove Road Homestead Field								X	X			X			X			X	X	6

Appendix 7b. Species recorded at each of 120 standardized surveys sites in Acadia National Park, 2001. Ranid species (RASP) represents unknown anuran larvae. Frequency of Occurrence is number of sites a species was recorded from, divided by total number of sites (120). Species codes are defined in Appendix 3 (continued).

Site Name	AMMA	BUAM	CHPI	CHSE	DIPU	EUBI	HESC	LATR	OPVE	NOVI	PLCI	PSCR	RACA	RACL	RAPA	RASP	RASY	STOC	THSI	# Spp.[1]
Seal Cove Road Pond			X							X		X				X	X			4
Seal Cove Road Woods						X					X			X						3
Seal Cove Road Woods (west)											X								X	2
Seawall Pond												X		X		X			X	3
Seawall Pond #2												X								1
Somes Pond Wetland			X									X		X	X					4
South Breakneck Pond			X									X	X		X					4
South Tarn Trail											X			X				X		3
Southeast of the Bowl/Kief Pond														X						1
Sunken Heath	X											X			X			X		4
Sunken Heath Vernal Pond												X					X			2
The Bowl												X	X						X	3
The Tarn												X		X						2
Two Moose Pond			X									X		X	X	X				4
Upper Hadlock Pond	X		X	X						X		X	X	X	X					8
Upper Precipice Beaver Pond	X											X			X					3
Valley Cove Pond														X						1
Western Mountain Road Wetland										X		X			X			X		4
Western Mountain Road Woods											X									1
Western Mountain/Lurvey Pond												X								1
Western Trail		X									X									2
Wetland after Halfway Marsh												X		X						2
Wetland past East Marsh													X	X						2

Appendix 7b. Species recorded at each of 120 standardized surveys sites in Acadia National Park, 2001. Ranid species (RASP) represents unknown anuran larvae. Frequency of Occurrence is number of sites a species was recorded from, divided by total number of sites (120). Species codes are defined in Appendix 3 (continued).

Site Name	AMMA	BUAM	CHPI	CHSE	DIPU	EUBI	HESC	LATR	OPVE	NOVI	PLCI	PSCR	RACA	RACL	RAPA	RASP	RASY	STOC	THSI	# Spp.[1]
Witch Hole Pond												X	X	X	X	X				4
Total Number of Sites	**28**	**5**	**17**	**13**	**2**	**7**	**3**	**5**	**9**	**13**	**17**	**58**	**28**	**47**	**41**	**20**	**14**	**12**	**39**	
Frequency of Occurrence	**0.2**	**0.04**	**0.2**	**0.1**	**0.02**	**0.1**	**0.0**	**0.04**	**0.1**	**0.1**	**0.1**	**0.5**	**0.2**	**0.4**	**0.3**	**0.2**	**0.1**	**0.1**	**0.3**	

[1] does not include Ranid species (RASP)

Appendix 8a. Habitat type and GPS positions for 161 incidental encounter locations in Acadia National Park, 2001. The Global Positioning System (GPS) position is presented as Universal Transverse Mercator (UTM) grid coordinates X=x-axis or East, and Y=y-axis or North.

Location Name	Habitat	GPS Position	
		UTM X	UTM Y
102 West Side	road	547683	4904620
111 Seal Cove Road	road	552675	4904088
ACAD Trail	trail	563103	4909870
Alder Trail	trail	575441	4910410
Asticou Trail	trail	557370	4906482
Aunt Betty Pond Carriage Road NE[1]	carriage road	558056	4913599
B19	pond/inlet	557987	4913297
B24	permanent pond	556386	4912812
B42	pond	562825	4909513
B43 Pool 2	pond	562827	4909998
B44	pond	563397	4910814
B62	pond/marsh	564168	4912572
B79	temporary pond	562994	4912621
B82	pond/marsh	559126	4917205
B99	wetland	560874	4916427
Beech Mt. Fire Tower Trail	trail	552271	4907077
Bernard South Face Trail	trail	550667	4904889
Bill Skip Auto[1]	road	553820	4903076
Blackwood's Campground	road	563339	4906576
Blackwood's Campground A Loop	road	563333	4906426
Breakneck Road	road	559450	4917724
Breakneck Road Parking Area	parking area	559468	4917759
Breakneck Road Woods	woodland	559613	4917237
Breakneck Stream	stream	559377	4916829
Bruce's Vernal Pond	temporary pond	560565	4914749
Bubble Brook Wetland at Eagle Lake	marsh	560139	4911490
Bubble Pond South/Site 267	pond	560881	4909745
C34	pond	558302	4912154
Cannon Brook/Door Mountain Trails Junction[1]	trail	562886	4909825
Canoe Point - Aunt Betty Pond	pond/trail	557846	4913472
Carriage Road - Asticou Trail	carriage road	558505	4907141
Carriage Road b/t Witch Hole Pond and B77[1]	carriage road	560541	4916797
Carriage Road next to B99	carriage road	560874	4916477
Carriage Road to Brown Mountain	carriage road	557493	4912195
Connor's Nubble Trail[1]	trail	559195	4911470
Cromwell Harbor Road	road	562758	4914273
Crooked Road	road	554672	4917302
Deer Brook Trail	trail	558300	4910006
Duck Brook Carriage Road	carriage road	560644	4915700
Duck Brook Vernal Pond	temporary pond	561399	4915614
Duck Harbor[1]	harbor	527925	4875065

Appendix 8a. Habitat type and GPS positions for 161 incidental encounter locations in Acadia National Park, 2001. The Global Positioning System (GPS) position is presented as Universal Transverse Mercator (UTM) grid coordinates X=x-axis or East, and Y=y-axis or North (continued).

Location Name	Habitat	GPS Position	
		UTM X	UTM Y
Eagle Lake Carriage Road	road	560200	4911902
Eagle Lake Carriage Road East Side[1]	carriage road	560064	4912856
Eagle Lake Carriage Road Pond	pond	559375	4914424
Eagle Lake Northeast Pond	pond	559684	4914030
Eagle Lake Tributary	intermittent stream	560227	4911886
East of Fawn Pond B82	pond	559159	4917148
Fawn Pond Trail	trail	558215	4917820
Fire Road to Bass Harbor Marsh	road	552037	4902500
Gilmore Meadow Site 2[1]	carriage road	558139	4912634
Gorge Trail	trail	562250	4911627
Great Head[1]	trail	565785	4908690
Great Meadow - Jessup Trail	trail	562926	4912690
Hadlock Brook Trail	trail	557342	4908934
Hadlock Stream Field	field	556747	4907363
Headquarters Carriage Road	carriage road	558873	4913656
Hobs Hell Hole	pond	557783	4912239
Hodgdon Pond West Side (Gary Stellpflug house)[1]	pond	548145	4907812
Indian Point Road	road	548711	4912447
Isle au Haut - ANP cabin	woodland	528928	4877057
Isle au Haut – Cabin Trail	trail	529121	4877251
Isle au Haut – Campground	campground	527784	4875026
Isle au Haut - Driveway off Long Pond Road	road	531253	4876024
Isle au Haut – Jimbo Falls Woods	woodland	528800	4878073
Isle au Haut - Long Pond Gravel Pit	temporary pond	531195	4875920
Isle au Haut - Long Pond Wetland	wetland	531336	4876756
Isle au Haut - Old Campground South	woodland	527952	4875231
Isle au Haut - Old Campground Trail	trail	527882	4875285
Isle au Haut - Park Road Site 1	road	529376	4874542
Isle au Haut - Park Road Site 2	road	528222	4876136
Isle au Haut - Park Road Site 3	road	528513	4878684
Isle au Haut - Park Road Site 4	road	528587	4878827
Isle au Haut - Park Road Site 5	road	528747	4879723
Isle au Haut - Ranger Station South Road #1	road	528607	4879456
Isle au Haut - Ranger Station South Road #2	road	528684	4879630
Isle au Haut - Robinson Marsh North	marsh	528583	4878762
Isle au Haut - Robinson Marsh Road	road	528591	4878818
Isle au Haut - Robinson Marsh South	marsh	528469	4878324
Isle au Haut – Shark Point Beach North	road	528222	4876092

Appendix 8a. Habitat type and GPS positions for 161 incidental encounter locations in Acadia National Park, 2001. The Global Positioning System (GPS) position is presented as Universal Transverse Mercator (UTM) grid coordinates X=x-axis or East, and Y=y-axis or North (continued).

Location Name	Habitat	GPS Position	
		UTM X	UTM Y
Isle au Haut – Shark Point South Road	road	527864	4875858
Isle au Haut Eastern Head Thunder Gulch Pond 1	temporary pond	530907	4873190
Isle au Haut Eastern Head Thunder Gulch Pond 2	temporary pond	530851	4873144
Isle au Haut Eastern Head Thunder Gulch Pond 3	temporary pond	530844	4873133
Isle au Haut Eastern Head Thunder Gulch Pond 4	temporary pond	530838	4873148
Isle au Haut Eastern Head Thunder Gulch Pond 5	temporary pond	530835	4873131
Isle au Haut Eastern Head Thunder Gulch Pond 6	temporary pond	530825	4873099
Isle au Haut Eastern Head Thunder Gulch Pond 7	temporary pond	530786	4873099
Isle au Haut Eastern Head Thunder Gulch Pond 8	temporary pond	530602	4873270
Isle au Haut Eastern Head Thunder Gulch Pond 9	temporary pond	530635	4874003
Isle au Haut Long Pond Trail 2[1]	trail	529468	4876783
Isle au Haut Long Pond Trail[1]	trail	530567	4876408
Isle au Haut Pond site 4	pond	529677	4874764
Isle au Haut site 10	field	529658	4874364
Isle au Haut site 4	pond	529659	4874769
Isle au Haut site 8	marsh	527802	4873981
Isle au Haut site 9	tide pool	528182	4873351
Jordan Pond Carriage Road Site 2[1]	carriage road	559433	4907858
Jordan Pond Carry Trail	trail	559557	4909495
Jordan Pond Gatehouse	house	559637	4907619
Jordan Pond Road	road	560508	4905819
Jordan Stream Trail	trail	559362	4907731
Karen Anderson's Driveway[1]	driveway	551722	4915504
Kay's Vernal Pond	temporary pond	555994	4913749
Lake Wood	permanent pond/lake	558325	4917472
Long Pond Fire Road North 1	temporary pond	547716	4908800
Long Pond Fire Road North 2	temporary pond	547785	4908847
Long Pond Fire Road Stream	stream	547979	4909044
Long Pond Fire Road Woods	woodland	548650	4907157
Long Pond Road	road	552486	4904282
Long Pond Site 2	pond	555403	4898525
Maple Spring	intermittent stream/spring	557888	4909721
MDI Private Land[1]	garden	552035	4915277
Northeast Marsh Eagle Lake	marsh	559640	4914067

Appendix 8a. Habitat type and GPS positions for 161 incidental encounter locations in Acadia National Park, 2001. The Global Positioning System (GPS) position is presented as Universal Transverse Mercator (UTM) grid coordinates X=x-axis or East, and Y=y-axis or North (continued).

Location Name	Habitat	GPS Position	
		UTM X	UTM Y
Northeast of Witch Hole Pond	trail	560382	4916821
Oak Hill Road	road	552948	4912477
Old Farm Road	road	564074	4913603
Otter Cliff Road[1]	road	564062	4907553
Paradise Hill[1]	carriage road	560346	4917074
Park Loop Road	road	529833	4874774
Park Loop Road - Stairs to Jordan Pond	trail	559679	4909357
Park Loop Road at Great Meadow	road	562948	4913395
Pretty Marsh Picnic Area	woodland	547516	4909039
Pretty Marsh Road	road	551561	4911527
Pretty Marsh Road Wetland	wetland	548553	4909875
Richardson's Brook	intermittent stream	556813	4912625
Richardson's Brook Wood South	woodland	556240	4912350
Richardson's Pond	permanent pond	555891	4912984
Ripples Road[1]	road	551117	4911016
Rocky Pasture Rd.	road	554802	4905368
Route 102 at Pretty Marsh	road	547555	4908952
Route 102[1]	road	548326	4909706
Route 102-west side	road	551677	4911532
Route 233	road	559755	4914082
Route 3 S. Blackwood's Campground	road	562637	4906958
Sand Beach Nursery	field	565224	4909207
Sand Point Road	road	557989	4920451
Sargent Mountain Pond	pond	558252	4909195
Sargent Mt. South Ridge Trail	trail	557788	4908430
Schoodic Head Trail	trail	575137	4910651
Schooner Head Road	road	564380	4912781
Seal Cove Road	road	550420	4902948
Seal Cove Road at Fire Rd	road	552293	4903819
Ship Harbor Trail	trail	553869	4897823
Sieur de Monts aband trail	trail	562950	4912488
Sieur de Monts Spring Foot Bridge[1]	trail	563080	4912414
Site 107	pond	560089	4916943
South Bubble Trail	trail	559644	4910046
Strath-Eden Trail	woodland/trail	562716	4912942
Sunken Heath Gravel Rd	road	556011	4913783
Sunken Heath Seep/ Ditch	seep	556035	4914417
Sunken Heath Woods	woodland	556099	4913824
Upper Hadlock Seep	seep	556811	4907463
Western Mountain Road	road	548944	4903714
Whitecap Brook	intermittent stream	560226	4912072
Whitney Farm Road	road	551011	4912914

Appendix 8a. Habitat type and GPS positions for 161 incidental encounter locations in Acadia National Park, 2001. The Global Positioning System (GPS) position is presented as Universal Transverse Mercator (UTM) grid coordinates X=x-axis or East, and Y=y-axis or North (continued).

Location Name	**Habitat**	**GPS Position**	
		UTM X	**UTM Y**
Wild Gardens of Acadia Pond (Sieur de Monts)	pond	563094	4912469
Wildwood Stables Vernal Pool	temporary pond	560410	4906996
Witch Hole Beaver Pond	beaver pond	560896	4916436
Witch Hole Carriage Road Site 2[1]	carriage road	560410	4915866
Witch Hole Carriage Road Site 3[1]	carriage road	559599	4915845
Young Mountain	trail	558239	4916267

[1]UTM position estimated from ARCVIEW

Appendix 8b. Species recorded at 161 incidental encounter locations in Acadia National Park, 2001. Ranid species (RASP) represents unknown anuran larvae. Frequency of Occurrence is the number of locations a species was identified from, divided by the total number of locations (161). Species codes are defined in Appendix 3 (continued).

Site Name	AMMA	BUAM	CHPI	CHSE	DIPU	EUBI	HESC	LATR	OPVE	NOVI	PLCI	PSCR	RACA	RACL	RAPA	RASP	RASY	STOC	THSI	# Spp.[1]
102 West Side			X																	1
111 Seal Cove Road								X												1
ACAD Trail																			X	1
Alder Trail									X											1
Asticou Trail																			X	1
Aunt Betty Pond Carriage Road NE																			X	1
B19																			X	1
B24			X												X				X	3
B42				X														X		2
B43 Pool 2			X	X										X					X	4
B44				X															X	2
B62				X																1
B79			X																	1
B82			X																	1
B99			X																	1
Beech Mt. Fire Tower Trail																			X	1
Bernard South Face Trail														X		X				1
Bill Skip Auto												X								1
Blackwood's Campground				X				X			X									3
Blackwood's Campground A Loop											X									1
Breakneck Road			X	X							X	X							X	5

Appendix 8b. Species recorded at 161 incidental encounter locations in Acadia National Park, 2001. Ranid species (RASP) represents unknown anuran larvae. Frequency of Occurrence is the number of locations a species was identified from, divided by the total number of locations (161). Species codes are defined in Appendix 3 (continued).

Site Name	AMMA	BUAM	CHPI	CHSE	DIPU	EUBI	HESC	LATR	OPVE	NOVI	PLCI	PSCR	RACA	RACL	RAPA	RASP	RASY	STOC	THSI	# Spp.[1]
Breakneck Road Parking Area																			X	1
Breakneck Road Woods																			X	1
Breakneck Stream																			X	1
Bruce's Vernal Pond							X							X						2
Bubble Brook Wetland at Eagle Lake													X							1
Bubble Pond South/Site 267																			X	1
C34																			X	1
Cannon Brook/Door Mountain Trails Junction[2]																		X		1
Canoe Point - Aunt Betty Pond									X										X	2
Carriage Road - Asticou Trail																			X	1
Carriage Road b/t Witch Hole Pond and B77																			X	1
Carriage Road next to B99			X																	1
Carriage Road to Brown Mountain			X																	1

Appendix 8b. Species recorded at 161 incidental encounter locations in Acadia National Park, 2001. Ranid species (RASP) represents unknown anuran larvae. Frequency of Occurrence is the number of locations a species was identified from, divided by the total number of locations (161). Species codes are defined in Appendix 3 (continued).

Site Name	AMMA	BUAM	CHPI	CHSE	DIPU	EUBI	HESC	LATR	OPVE	NOVI	PLCI	PSCR	RACA	RACL	RAPA	RASP	RASY	STOC	THSI	# Spp.[1]
Connor's Nubble Trail[1]																			X	1
Cromwell Harbor Road												X								1
Crooked Road												X					X			2
Deer Brook Trail																			X	1
Duck Brook Carriage Road	X											X								2
Duck Brook Vernal Pond	X															X	X			2
Duck Harbor[2]																			X	1
Eagle Lake Carriage Rd											X									1
Eagle Lake Carriage Road East Side								X											X	2
Eagle Lake Carriage Road Pond	X		X									X								3
Eagle Lake Northeast Pond	X												X	X						3
Eagle Lake Tributary											X									1
East of Fawn Pond B82														X					X	2
Fawn Pond Trail																			X	1
Fire Road to Bass Harbor Marsh																			X	1

Appendix 8b. Species recorded at 161 incidental encounter locations in Acadia National Park, 2001. Ranid species (RASP) represents unknown anuran larvae. Frequency of Occurrence is the number of locations a species was identified from, divided by the total number of locations (161). Species codes are defined in Appendix 3 (continued).

Site Name	AMMA	BUAM	CHPI	CHSE	DIPU	EUBI	HESC	LATR	OPVE	NOVI	PLCI	PSCR	RACA	RACL	RAPA	RASP	RASY	STOC	THSI	# Spp.[1]
Gilmore Meadow Site 2																			X	1
Gorge Trail																			X	1
Great Head[1]					X															1
Great Meadow - Jessup Trail																			X	1
Hadlock Brook Trail											X				X				X	3
Hadlock Stream Field																				0
Headquarters Carriage Road																	X		X	2
Hobs Hell Hole																			X	1
Hodgdon Pond West Side (Gary Stellpflug house)		X	X	X								X	X	X	X		X			8
Indian Point Road	X									X				X						3
Isle au Haut - ANP cabin																			X	1
Isle au Haut – Cabin Trail											X									1
Isle au Haut – Campground									X											1
Isle au Haut - Driveway off Long Pond Road																		X		1

Appendix 8b. Species recorded at 161 incidental encounter locations in Acadia National Park, 2001. Ranid species (RASP) represents unknown anuran larvae. Frequency of Occurrence is the number of locations a species was identified from, divided by the total number of locations (161). Species codes are defined in Appendix 3 (continued).

Site Name	AMMA	BUAM	CHPI	CHSE	DIPU	EUBI	HESC	LATR	OPVE	NOVI	PLCI	PSCR	RACA	RACL	RAPA	RASP	RASY	STOC	THSI	# Spp.[1]
Isle au Haut – Jimbo Falls Woods																			X	1
Isle au Haut - Long Pond Gravel Pit									X											1
Isle au Haut - Long Pond Wetland																			X	1
Isle au Haut - Old Campground South									X											1
Isle au Haut - Old Campground Trail									X											1
Isle au Haut - Park Road Site 1									X											1
Isle au Haut - Park Road Site 2									X										X	2
Isle au Haut - Park Road Site 3									X											1
Isle au Haut - Park Road Site 4																			X	1
Isle au Haut - Park Road Site 5																		X		1
Isle au Haut - Ranger Station South Road #1																			X	1

Appendix 8b. Species recorded at 161 incidental encounter locations in Acadia National Park, 2001. Ranid species (RASP) represents unknown anuran larvae. Frequency of Occurrence is the number of locations a species was identified from, divided by the total number of locations (161). Species codes are defined in Appendix 3 (continued).

Site Name	AMMA	BUAM	CHPI	CHSE	DIPU	EUBI	HESC	LATR	OPVE	NOVI	PLCI	PSCR	RACA	RACL	RAPA	RASP	RASY	STOC	THSI	# Spp.[1]
Isle au Haut - Ranger Station South Road #2																			X	1
Isle au Haut - Robinson Marsh North																			X	1
Isle au Haut - Robinson Marsh Road																	X			1
Isle au Haut - Robinson Marsh South									X										X	2
Isle au Haut – Shark Point Beach North									X											1
Isle au Haut – Shark Point South Road									X											1
Isle au Haut Eastern Head Thunder Gulch Pond 1	X																			1
Isle au Haut Eastern Head Thunder Gulch Pond 2	X																			1

Appendix 8b. Species recorded at 161 incidental encounter locations in Acadia National Park, 2001. Ranid species (RASP) represents unknown anuran larvae. Frequency of Occurrence is the number of locations a species was identified from, divided by the total number of locations (161). Species codes are defined in Appendix 3 (continued).

Site Name	AMMA	BUAM	CHPI	CHSE	DIPU	EUBI	HESC	LATR	OPVE	NOVI	PLCI	PSCR	RACA	RACL	RAPA	RASP	RASY	STOC	THSI	# Spp.[1]
Isle au Haut Eastern Head Thunder Gulch Pond 3	X																			1
Isle au Haut Eastern Head Thunder Gulch Pond 4	X																X			2
Isle au Haut Eastern Head Thunder Gulch Pond 5	X																			1
Isle au Haut Eastern Head Thunder Gulch Pond 6	X																			1
Isle au Haut Eastern Head Thunder Gulch Pond 7	X																			1
Isle au Haut Eastern Head Thunder Gulch Pond 8	X																			1
Isle au Haut Eastern Head Thunder Gulch Pond 9	X																			1

Appendix 8b. Species recorded at 161 incidental encounter locations in Acadia National Park, 2001. Ranid species (RASP) represents unknown anuran larvae. Frequency of Occurrence is the number of locations a species was identified from, divided by the total number of locations (161). Species codes are defined in Appendix 3 (continued).

Site Name	AMMA	BUAM	CHPI	CHSE	DIPU	EUBI	HESC	LATR	OPVE	NOVI	PLCI	PSCR	RACA	RACL	RAPA	RASP	RASY	STOC	THSI	# Spp.[1]
Isle au Haut Long Pond Trail 2																			X	1
Isle au Haut Long Pond Trail																			X	1
Isle au Haut Pond site 4	X														X					2
Isle au Haut site 10									X										X	2
Isle au Haut site 4																			X	1
Isle au Haut site 8	X																			1
Isle au Haut site 9	X																			1
Jordan Pond Carriage Road Site 2																			X	1
Jordan Pond Carry Trail																			X	1
Jordan Pond Gatehouse															X				X	2
Jordan Pond Road				X																1
Jordan Stream Trail																			X	1
Karen Anderson's Driveway																			X	1
Kay's Vernal Pond																	X			1
Lake Wood				X									X						X	3
Long Pond Fire Road North 1	X						X				X									3

Appendix 8b. Species recorded at 161 incidental encounter locations in Acadia National Park, 2001. Ranid species (RASP) represents unknown anuran larvae. Frequency of Occurrence is the number of locations a species was identified from, divided by the total number of locations (161). Species codes are defined in Appendix 3 (continued).

Site Name	AMMA	BUAM	CHPI	CHSE	DIPU	EUBI	HESC	LATR	OPVE	NOVI	PLCI	PSCR	RACA	RACL	RAPA	RASP	RASY	STOC	THSI	# Spp.[1]
Long Pond Fire Road North 2							X													1
Long Pond Fire Road Stream						X														1
Long Pond Fire Road Woods															X					1
Long Pond Road				X																1
Long Pond Site 2														X						1
Maple Spring												X		X						2
MDI Private Land		X			X															2
Northeast Marsh Eagle Lake	X												X	X						3
Northeast of Witch Hole Pond				X														X		2
Oak Hill Road	X						X			X	X	X	X		X					7
Old Farm Road													X						X	2
Otter Cliff Road								X												1
Paradise Hill														X						1
Park Loop Road																		X		1
Park Loop Road - Stairs to Jordan Pond					X															1
Park Loop Road at Great Meadow	X													X						2
Pretty Marsh Picnic Area											X									1
Pretty Marsh Road	X											X					X			3

Appendix 8b. Species recorded at 161 incidental encounter locations in Acadia National Park, 2001. Ranid species (RASP) represents unknown anuran larvae. Frequency of Occurrence is the number of locations a species was identified from, divided by the total number of locations (161). Species codes are defined in Appendix 3 (continued).

Site Name	AMMA	BUAM	CHPI	CHSE	DIPU	EUBI	HESC	LATR	OPVE	NOVI	PLCI	PSCR	RACA	RACL	RAPA	RASP	RASY	STOC	THSI	# Spp.[1]
Pretty Marsh Road Wetland												X					X			2
Richardson's Brook														X	X					2
Richardson's Brook Wood South											X									1
Richardson's Pond														X						1
Ripples Road[2]											X									1
Rocky Pasture Rd.								X												1
Route 102 at Pretty Marsh															X					1
Route 102	X																			1
Route 102-west side				X																1
Route 233	X		X	X																3
Route 3 S. Blackwood's Campground	X			X						X						X	X		X	5
Sand Beach Nursery	X																X			2
Sand Point Road							X				X									2
Sargent Mountain Pond	X													X						2
Sargent Mt. South Ridge Trail									X											1

Appendix 8b. Species recorded at 161 incidental encounter locations in Acadia National Park, 2001. Ranid species (RASP) represents unknown anuran larvae. Frequency of Occurrence is the number of locations a species was identified from, divided by the total number of locations (161). Species codes are defined in Appendix 3 (continued).

Site Name	AMMA	BUAM	CHPI	CHSE	DIPU	EUBI	HESC	LATR	OPVE	NOVI	PLCI	PSCR	RACA	RACL	RAPA	RASP	RASY	STOC	THSI	# Spp.[1]
Schoodic Head Trail	X																			1
Schooner Head Road				X																1
Seal Cove Road				X																1
Seal Cove Road at Fire Rd	X																			1
Ship Harbor Trail									X										X	2
Sieur de Monts aband trail											X								X	2
Sieur de Monts Spring Foot Bridge																			X	1
Site 107							X													1
South Bubble Trail																			X	1
Strath-Eden Trail											X									1
Sunken Heath Gravel Rd	X								X										X	3
Sunken Heath Seep/ Ditch	X																			1
Sunken Heath Woods											X									1
Upper Hadlock Seep	X											X					X			3
Western Mountain Road																			X	1
Whitecap Brook											X									1

Appendix 8b. Species recorded at 161 incidental encounter locations in Acadia National Park, 2001. Ranid species (RASP) represents unknown anuran larvae. Frequency of Occurrence is the number of locations a species was identified from, divided by the total number of locations (161). Species codes are defined in Appendix 3 (continued).

Site Name	AMMA	BUAM	CHPI	CHSE	DIPU	EUBI	HESC	LATR	OPVE	NOVI	PLCI	PSCR	RACA	RACL	RAPA	RASP	RASY	STOC	THSI	# Spp.[1]
Whitney Farm Road	X									X	X	X								4
Wild Gardens of Acadia Pond (Sieur de Monts)														X						1
Wildwood Stables Vernal Pool	X													X	X					3
Witch Hole Beaver Pond									X				X	X						3
Witch Hole Carriage Road Site 2																		X		1
Witch Hole Carriage Road Site 3																			X	1
Young Mountain								X												1
Total Number of Sites	**34**	**2**	**12**	**16**	**3**	**1**	**6**	**6**	**17**	**4**	**18**	**13**	**8**	**18**	**10**	**3**	**12**	**7**	**58**	
Frequency of Occurrence	**0.2**	**0.01**	**0.07**	**0.1**	**0.02**	**0.01**	**0.04**	**0.04**	**0.1**	**0.02**	**0.1**	**0.08**	**0.05**	**0.1**	**0.07**	**0.02**	**0.07**	**0.04**	**0.4**	

[1]does not include Ranid species (RASP)

Appendix 9.All snakes captured and measured in Acadia National Park, 11 May to 20, September, 2001. SVL=snout vent length, TL=total length, and Wgt=weight. IE=Incidental Encounter, CB=Coverboard Survey, TCS=Time Constrained Search

Species	Date	Locality	Method	Board #	Type	SVL (mm)	TL (mm)	Wgt (g)	Sex
Northern Ring-necked Snake	29 May	Fawn Pond	IE	-	-	229	285	-	Unknown
	7 Aug	Isle au Haut Old Gravel Pit	CB	135	metal	264	341	7.0	Unknown
Eastern Milk Snake	25 July	Seal Cove Road Homestead	CB	86	metal	-	370	-	Unknown
	5 Jun	Cadillac Mountain Field	IE	-	-	602	692	79.5	Unknown
Smooth Green Snake	5 June	Cadillac Mountain Field	CB	115	metal	297	411	21.6	Female
	7 Aug	Isle au Haut - Merchants Cove	IE	-	-	248	350	9.6	Unknown
	7 Aug	Isle au Haut - Merchants Cove	IE	-	-	284	386	16.7	Female
	18 Sep	Isle au Haut - Merchants Cove	IE	-	-	227	352	9.5	Unknown
	7 Aug	Isle au Haut - Old Campground	IE	-	-	327	452	15.8	Female
	7 Aug	Isle au Haut - Old Campground	IE	-	-	247	371	10.3	Unknown
	7 Aug	Isle au Haut - Old Campground	IE	-	-	265	377	12.5	Unknown
	7 Aug	Isle au Haut - Old Campground	IE	-	-	266	374	11	Unknown
	7 Aug	Isle au Haut - Old Campground South	IE	-	-	171	225	3	Unknown
	18 Sep	Isle au Haut - Park Rd. Site 1	IE	-	-	285	365	14.5	Unknown
	18 Sep	Isle au Haut - Park Rd. Site 2	IE	-	-	390	405	12.5	Unknown
	18 Sep	Isle au Haut - Robinson Marsh South	IE	-	-	242	360	12	Unknown
	7 Aug	Isle au Haut - Shark Point Beach	IE	-	-	310	425	18.3	Female
	7 Aug	Isle au hHaut - Old Campground	IE	-	-	165	236	4.5	Unknown
	7 Aug	Isle au hHaut - Old Campground	IE	-	-	171	228	4	Unknown
	14 Aug	MARS	CB	13	wood	163	218	11.5	Unknown
	7 Sep	Sargent Mountain South Ridge Trail	IE	-	-	330	435	23	Unknown
	6 June	Seal Cove Road Homestead	CB	86	metal	99	152	< 1.0	Unknown
	6 June	Seal Cove Road Homestead	CB	86	metal	288	405	14.8	Female
	6 June	Seal Cove Road Homestead	CB	86	metal	109	153	< 1.0	Unknown
	6 June	Seal Cove Road Homestead	CB	86	metal	261	375	14.5	Female
	6 June	Seal Cove Road Homestead	CB	86	metal	279	388	13.5	Female
	6 June	Seal Cove Road Homestead	CB	86	metal	119	161	< 1.0	Unknown

Appendix 9 All snakes captured and measured in Acadia National Park, 11 May to 20, September, 2001 (continued).

Species	Date	Locality	Method	Board #	Type	SVL (mm)	TL (mm)	Wgt (g)	Sex
Northern Red-bellied Snake	25 Jul	Bar Island Fields	IE	-	-	-	160	-	Unknown
	24 May	Beech Hill Road	CB	79	wood	217	265	8.0	Female
	24 May	Beech Hill Road	CB	80	metal	221	263	7.8	Female
	29 June	Beech Hill Road	CB	77	wood	-	-	-	Unknown
	29 June	Beech Hill Road	CB	77	wood	-	242	-	Female
	29 June	Beech Hill Road	CB	83	wood	-	125	-	Unknown
	29 June	Beech Hill Road	CB	84	metal	-	135	-	Unknown
	6 June	Hodgdon Pond Field	CB	118	wood	208	274	5.4	Male
	6 June	Hodgdon Pond Field	CB	119	metal	190	236	8.3	Female
	6 June	Hodgdon Pond Field	CB	129	metal	180	227	5.5	Female
	15 Aug	Hodgdon Pond Field	CB	119	metal	190	235	9.0	Female
	4 Sept	Hodgdon Pond Field	CB	121	metal	-	-	-	-
	7 Aug	Isle au Haut - Merchant's Cove	IE	-	-	209	266	5.7	Unknown
	18 Sep	Isle au Haut - Park Rd. Site 5	IE	-	-	190	240	4	Unknown
	5 June	MARS	CB	18	metal	-	-	-	Unknown
	5 June	MARS	CB	18	metal	181	236	5.3	Female
	5 June	MARS	CB	18	metal	-	-	-	Unknown
	14 Aug	MARS	CB	13	wood	200	250	16.5	Female
	14 Aug	MARS	CB	15	wood	188	231	13.0	Female
	31 May	Sand Beach Field Front	CB	98	metal	213	265	-	Female
	14 Aug	Sand Beach Field Front	CB	98	metal	225	285	20.5	F-gravid
	6 June	Seal Cove Road Field Site 1	CB	199	scrap wood	-	-	-	-
	19 June	Seal Cove Road Field Site 1	CB	199	scrap wood	82	108	< 1.0	Unknown
	4 Sept	Seal Cove Road Field Site 1	CB	60	metal	228	283	7.4	Female
	4 Sept	Seal Cove Road Field Site 1	CB	63	metal	197	244	6.0	Female
	4 Sept	Seal Cove Road Field Site 1	CB	63	metal	168	215	3.0	Male
	4 Sept	Seal Cove Road Field Site 1	CB	199	scrap wood	169	221	3.0	Male
	6 June	Seal Cove Road Homestead	CB	86	metal	199	241	3.5	Female
	6 June	Seal Cove Road Homestead	CB	86	metal	188	236	1.0	Male
	29 June	Seal Cove Road Homestead	CB	86	metal	194	245	4.3	Female
	29 June	Seal Cove Road Homestead	CB	86	metal	198	240	5.3	Female
	16-Aug	South Tarn Trail	TCS	-	-	225	275	8.5	Female
	13-Aug	Western Mountain Road Wetland	TCS	-	-	240	310	15.5	Unknown

Appendix 9 All snakes captured and measured in Acadia National Park, 11 May to 20, September, 2001 (continued).

Species	Date	Locality	Method	Board #	Type	SVL (mm)	TL (mm)	Wgt (g)	Sex
Common Garter Snake	21 May	Bar Island Fields	CB	71	metal	-	-	-	Unknown
	8 June	Beech Hill Road	CB	80	metal	-	-	33.0	Unknown
	8 June	Beech Hill Road	CB	80	metal	-	-	-	Unknown
	29 June	Beech Hill Road	CB	80	metal	-	230	-	Male
	24 Aug	Beech Hill Road	CB	80	metal	429	536	37.0	Male
	11 June	Blackwoods Field	CB	108	wood	407	509	45.0	Female
	7 Jun	Breakneck Road Woods	IE	-	-	281	362	6.7	Male
	5 June	Cadillac Mountain Field	CB	36	metal	309	387	14.0	Female
	5 June	Cadillac Mountain Field	CB	115	metal	333	421	24.5	Female
	21 June	Cadillac Mountain Field	CB	36	metal	190	241	5.3	Unknown
	9 Aug	Fernald Point	CB	48	metal	328	419	22.0	Female
	16 Aug	Half Moon Pond	IE	-	-	146	187	2.25	Unknown
	15 Aug	Hodgdon Pond Field	CB	120	wood	470	600	87.0	Female
	20 Sept	Hodgdon Pond Field	CB	121	metal	149	196	4.0	Unknown
	22 May	Hogdon Pond	IE	-	-	-	670	82	Unknown
	7 Aug	Isle au Haut - ANP Cabin	IE	-	-	600	740	132	Unknown
	8 Aug	Isle au Haut - Jimbo Falls Woods	IE	-	-	362	472	20	Male
	8 Aug	Isle au Haut - Long Pond Wetland	IE	-	-	304	392	11.5	Unknown
	18 Jun	Isle au Haut - Merchant's Cove	IE	-	-	-	630	-	Unknown
	18 Jun	Isle au Haut - Merchant's Cove	IE	-	-	380	450	-	Unknown
	18 Jun	Isle au Haut - Old Campground	IE	-	-	275	330	-	Unknown
	18 Jun	Isle au Haut - Old Cemetery	IE	-	-	350	430	-	Unknown
	18 Sep	Isle au Haut - Park Rd. Site 2	IE	-	-	215	275	6.5	Unknown
	7 Aug	Isle au Haut - Pond Site 1	IE	-	-	212	282	6.4	Unknown
	11 May	Isle au Haut - Pond Site 3	IE	-	-	530	665	105	Unknown
	8 Aug	Isle au Haut - Robinson Marsh South	IE	-	-	351	467	26.5	Unknown
	16 Jun	Isle au Haut - Shark Point Beach	IE	-	-	245	310	-	Unknown
	11 May	Isle au Haut - Site 4	IE	-	-		225	75	Unknown

Appendix 9 All snakes captured and measured in Acadia National Park, 11 May to 20, September, 2001 (continued).

Species	Date	Locality	Method	Board #	Type	SVL (mm)	TL (mm)	Wgt (g)	Sex
Common Garter Snake	28-Aug	Long Pond Trail	TCS	-	-	470	590	40	Unknown
	28-Jun	Lower Hadlock Pond	IE	-	-	528	667	-	Female
	31 May	Sand Beach Field Back	CB	25	metal	-	-	-	Unknown
	27 June	Sand Beach Field Back	CB	25	metal	353	451	26.8	Male
	28 Aug	Sand Beach Field Back	CB	100	metal	427	568	36.0	Male
	18 Sept	Sand Beach Field Back	CB	26	wood	147	190	2.0	Unknown
	14 Aug	Sand Beach Field Front	CB	100	metal	485	615	68.0	Female
	6 June	Seal Cove Road Field Site 1	CB	64	wood	194	230	1.5	Female
	16 May	Seal Cove Road Homestead	CB	86	metal	-	330	-	Male
	6 June	Seal Cove Road Homestead	CB	86	metal	382	463	32.0	Female
	6 June	Seal Cove Road Homestead	CB	86	metal	381	486	36.0	Male
	25 July	Seal Cove Road Homestead	CB	86	metal	-	240	-	Unknown
	25 July	Seal Cove Road Homestead	CB	86	metal	-	340	-	Male
	9 Aug	Seal Cove Road Homestead	CB	91	wood	385	479	24.5	Male
	25 Jul	Seal Cove Road Woods West	IE	-	-	-	336	-	Male

Appendix 10. All Painted Turtles captured in Acadia National Park, 20 April to 20 June 2001. Notch codes were assigned according to a modified system described in Cagle (1939) and illustrated in Figure 1.

Site	Date	Sex	Notch Code	Carapace Length (mm)	Carapace Width (mm)	Plastron Length (mm)	Plastron Width (mm)	Weight (g)
Beaver Dam/Muck Pond	25-Apr	Female	R2	164.5	115.1	155.9	91.8	550
Beaver Dam/Muck Pond	25-Apr	Female	R3	123.4	92.3	118.0	76.0	250
Beaver Dam/Muck Pond	19-May	Female	R3,8,9	172.2	121.7	161.4	93.1	570
Beaver Dam/Muck Pond	25-Apr	Male	R1,2	127.1	91.9	120.2	73.5	249
Duck Pond	31-May	Female	R1,4,8,10	146.2	109.9	145.7	91.1	475
Duck Pond	29-May	Female	R13 - L11	164	119	154	95	620
Fawn Pond	20-Jun	Female	R1,3,8,11	114.9	90.4	110.8	70.0	212
Fawn Pond	29-May	Female	R1,4,10	145.7	109.0	138.8	87.2	465
Fawn Pond	29-May	Female	R2,3,10	159.8	116.2	154.0	93.5	545
Fawn Pond	06-Jun	Female	R2,3,9,10	126.5	101.5	122.6	83.9	305
Fawn Pond	06-Jun	Female	R3,9,10	128.0	100.4	125.5	84.6	300
Fawn Pond	29-May	Female	R8,10	110.1	87.3	105.6	70.4	195
Fawn Pond	13-Jun	Male	R1,2,11	138.1	103.8	131.3	84.3	301
Fawn Pond	20-Jun	Male	R1,2,8,11	112.9	86.4	108.3	69.9	185
Fawn Pond	20-Jun	Male	R1,8,11	110.8	82.9	105.0	66.2	-
Geronimo Pond	07-Jun	Female	R12 - L3,10	165.1	119.1	157.1	94.5	500
Geronimo Pond	08-Jun	Male	R1,3,9,10	121.1	92.0	103.5	74.5	126
Geronimo Pond	08-May	Male	R2,3,9	140.3	102.1	130.0	83.1	335
Hodgdon Pond	02-May	Female	R1,4	146.0	107.1	138.2	86.7	394
Hodgdon Pond	22-May	Female	R2,3,8,9	77.2	65.6	74.6	51.2	69
Hodgdon Pond	06-Jun	Male	R1,3,8,10	144.6	107.2	134.5	87.0	335

Appendix 10 All Painted Turtles captured in Acadia National Park, 20 April to 20 June 2001 (continued).

Site	Date	Sex	Notch Code	Carapace Length (mm)	Carapace Width (mm)	Plastron Length (mm)	Plastron Width (mm)	Weight (g)
Hodgdon Pond	22-May	Male	R1,4,8,9	105.9	79.5	101.1	62.2	145
Hodgdon Pond	22-May	Male	R10	86.2	71.7	82.6	56.5	95
Hodgdon Pond	22-May	Male	R11	152.9	110.9	143.2	195.1	410
Hodgdon Pond	01-May	Male	R2,3	158.1	111.5	146.8	89.1	447
Hodgdon Road Pond	13-Jun	Female	L3, 8,12, R8, 10	169.0	120.5	165.5	95.7	550
Little Turtle Pond	05-May	-	R1,2,8	48.0	47.0	42.9	37.2	21
Little Turtle Pond	05-May	-	R1,3,8	72.4	67.0	69.0	51.6	65
Little Turtle Pond	04-May	-	R2,8	72.1	67.0	67.4	50.7	60
Little Turtle Pond	04-May	-	R3,8	51.3	50.0	46.9	38.5	25
Little Turtle Pond	04-May	-	R8	52.1	51.5	49.1	39.0	-
Little Turtle Pond	30-May	-	R9,10	56.2	54.7	51.5	41.5	33
Little Turtle Pond	30-May	Female	L3,9	164.8	120.5	158.5	94.0	600
Little Turtle Pond	01-Jun	Female	R1,2,8,10	74.6	65.4	70.6	50.4	71
Little Turtle Pond	22-May	Female	R1,3,8,9	78.0	68.1	72.3	53.2	75
Little Turtle Pond	04-May	Female	R1,4,8	156.2	112.0	149.8	91.2	496
Little Turtle Pond	01-Jun	Female	R10 - L2,8	161.7	120.8	155.7	99.2	535
Little Turtle Pond	08-May	Female	R2,4,9	152.5	110.8	138.9	95.2	410
Little Turtle Pond	30-May	Female	R2,8,10	125.9	98.1	120.2	78.3	270
Little Turtle Pond	03-May	Female	R4	74.8	69.0	74.5	56.3	72
Little Turtle Pond	29-May	Female	R8,11 - L2,8,10	173.7	128.3	169.7	101.4	715
Little Turtle Pond	04-May	Female	R8,12 - L1,8	175.1	126.3	171.0	99.5	678
Little Turtle Pond	04-May	Female	R9	166.6	119.0	164.7	94.5	605
Little Turtle Pond	08-May	Male	R1,2,9	125.5	94.3	115.1	80.8	235

Appendix 10 All Painted Turtles captured in Acadia National Park, 20 April to 20 June 2001 (continued).

Site	Date	Sex	Notch Code	Carapace Length (mm)	Carapace Width (mm)	Plastron Length (mm)	Plastron Width (mm)	Weight (g)
Little Turtle Pond	08-May	Male	R1,3,9	122.0	96.7	121.3	83.6	220
Little Turtle Pond	04-May	Male	R1,8	154.2	109.5	143.2	85.7	420
Little Turtle Pond	08-May	Male	R1,8,9	137.5	120.6	128.3	85.0	310
Little Turtle Pond	08-May	Male	R1,9	137.7	101.9	130.4	86.2	300
Little Turtle Pond	04-May	Male	R2,3,8	132.1	97.0	122.5	77.3	294
Little Turtle Pond	03-May	Male	R2,4	138.9	103.1	129.1	82.6	320
Little Turtle Pond	07-May	Male	R2,9	129.7	96.5	120.1	75.5	251
Little Turtle Pond	30-May	Male	R3,8,10	144.0	102.0	137.3	81.2	335
Little Turtle Pond	08-May	Male	R4,8,9	134.8	99.5	124.9	84.2	280
Little Turtle Pond	22-May	Male	R4,8,9	136.8	96.3	122.6	79.7	284
Little Turtle Pond	08-May	Male	R4,9	132.8	100.5	123.0	84.1	265
Little Turtle Pond	01-Jun	Male	R8 - L2,8,10	165.4	122.1	161.7	97.5	590
North Breakneck Pond	08-May	-	R2,4,8	39.5	38.9	35.1	29.9	10
North Breakneck Pond	18-May	-	R2,8,9	66.5	57.4	61.9	44.8	45
North Breakneck Pond	12-Jun	Female	R1,11	107.1	82.0	102.5	68.3	165
North Breakneck Pond	08-Jun	Female	R1,2,9,10	107.9	86.1	101.8	68.9	94
North Breakneck Pond	12-Jun	Female	R1,4,9,10	153.5	112.5	142.1	92.7	450
North Breakneck Pond	30-May	Female	R1,8,10	151.4	113.5	143.1	90.5	500
North Breakneck Pond	30-May	Female	R2,4,10	141.1	105.7	138.1	88.1	355
North Breakneck Pond	08-May	Female	R4,8	177.8	124.9	168.0	101.0	650
North Breakneck Pond	12-Jun	Female	R4,9,10	151.9	114.1	144.9	93.7	445
North Breakneck Pond	12-Jun	Male	L1	154.2	110.1	143.1	85.7	395

Appendix 10 All Painted Turtles captured in Acadia National Park, 20 April to 20 June 2001 (continued).

Site	Date	Sex	Notch Code	Carapace Length (mm)	Carapace Width (mm)	Plastron Length (mm)	Plastron Width (mm)	Weight (g)
North Breakneck Pond	07-Jun	Male	R1,9,10	147.2	106.6	138.5	81.6	310
North Breakneck Pond	07-Jun	Male	R2,4,8,10	128.4	101.5	120.2	78.5	184
North Breakneck Pond	30-May	Male	R4,10	98.0	78.4	92.9	63.0	150
North Breakneck Pond	07-Jun	Male	R4,8,10	117.3	89.7	112.6	70.2	108
Northeast Creek	29-May	Female	L8,11	167.1	119.5	158.7	97.2	595
Northeast Creek	23-May	Female	R1,10	169.8	123.1	161.5	97.8	670
Northeast Creek	23-May	Female	R1,3,10	153.4	112.6	144.9	95.5	450
Northeast Creek	14-Jun	Female	R10 - L3,8,11	163.1	120.7	155.8	100.8	575
Northeast Creek	13-Jun	Female	R2 - L2	179.4	126.9	172.0	99.7	810
Northeast Creek	30-May	Female	R2,3,8,10	169.1	121.6	162.3	99.5	685
Northeast Creek	23-May	Female	R2,4,8,9	173.3	125.1	168.5	100.3	760
Northeast Creek	29-May	Female	R3,10	157.1	110.5	148.9	91.6	500
Northeast Creek	08-Jun	Female	R3,11	170.7	121.5	159.2	97.1	525
Northeast Creek	23-May	Male	R1,2,10	151.0	114.7	142.2	89.9	420
Northeast Creek	13-Jun	Male	R1,3,11	132.0	95.2	122.9	78.0	290
Northeast Creek	29-May	Male	R2,10	143.5	105.7	135.0	79.2	380
Northeast Creek	05-Jun	Male	R2,9,10	122.8	90.0	116.4	74.1	250
Seal Cove Road Pond	20-Apr	Female	R1	165	118	156	-	590
Seal Cove Road Pond	24-Apr	Male	R8,9 - L1,9	155.0	107.8	146.5	86.1	435
South Breakneck Pond	07-May	Female	R9 - L2,9	145.7	109.0	140.6	88.6	360
Upper Hadlock Pond	19-May	Female	L2,8	161.1	117.7	156.4	99.0	520
Upper Hadlock Pond	02-May	Female	R1,3	165.6	120.0	158.5	96.0	590
Upper Hadlock Pond	09-May	Male	R1,4,9	148.4	105.0	135.4	87.1	375
Upper Hadlock Pond	08-May	Male	R3,9	122.8	92.0	115.8	71.3	233

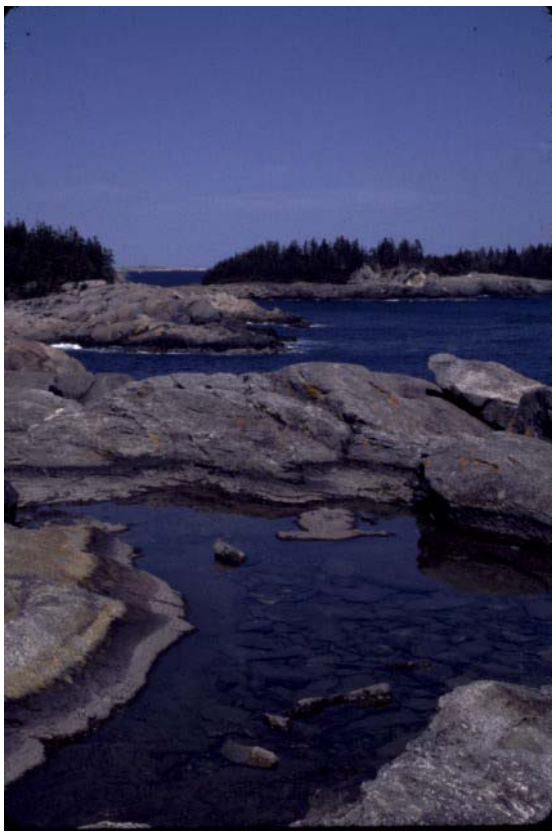
Appendix 11. All Snapping Turtles captured in Acadia National Park,25 April to 20 June 2001. Notch codes were assigned according to a modified system described in Cagle (1939) and illustrated in Figure 1.

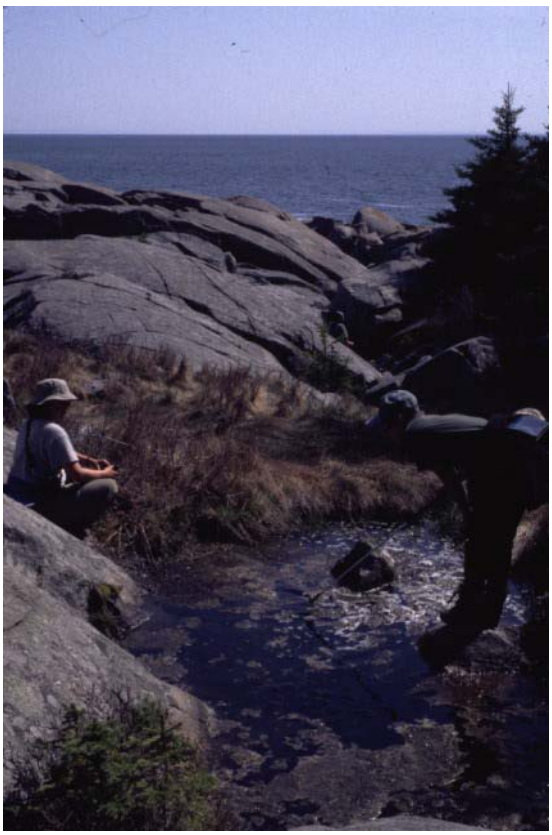
Site	Date	Sex	Notch Code	Carapace Length (mm)	Carapace Width (mm)	Plastron Length (mm)	Plastron Width (mm)	Weight (g)
Beaver Dam/Muck Pond	25-Apr	Female	R1	>300	274.3	219.0	221.0	-
Beaver Dam/Muck Pond	04-May	Male	R1,3	310-320	233.3	214.2	201.2	-
Beaver Dam/Muck Pond	25-Apr	Male	R2	340	275.0	234.0	224.5	-
Fawn Pond	29-May	Male	L8	266.7	222.0	200.1	182.2	4400
Fawn Pond	06-Jun	Male	L9	245.6	184.5	173.1	148.0	-
Fawn Pond	15-Jun	Male	R10 - L10	257.2	216.3	181.1	167.1	3300
Fawn Pond	29-May	Male	R11	410	350	285	-	-
Fawn Pond	11-Jun	Female	R11 - L8	-	217.4	197.5	191.2	-
Fawn Pond	30-May	Male	R3,8	224.2	177.0	165.3	146.0	2400
Fawn Pond	13-Jun	Male	R4,8	236.9	189.5	163.7	149.1	2600
Fawn Pond	20-Jun	Male	R8 - L8,9	274.3	227.5	203.8	199.6	-
Fawn Pond	29-May	Male	R9,11	255.1	207.0	181.5	170.8	3400
Fawn Pond	20-Jun	Male	R9,11 - L8	295.7	271.3	203.2	202.4	-
Geronimo Pond	20-May	Male	R1,2,8	222.6	181.4	157.1	155.4	2100
Geronimo Pond	20-May	Male	R1,8	269.3	221.3	193.8	195.7	-
Geronimo Pond	30-May	Male	R10 - L8	296.4	247.2	202.7	198.5	-
Geronimo Pond	31-May	Female	R11,12	-	-	189.5	161.2	-
Geronimo Pond	24-May	Male	R8	280	251	201	190	4700
Geronimo Pond	30-May	Male	R8 - L8	300.2	255.9	229.9	203.6	-
Geronimo Pond	07-Jun	Male	R8,10 - L8	242.1	202.3	179.7	155.4	3400
Geronimo Pond	30-May	Male	R8,9 - L8	343.5	316.3	247.2	231.6	-
Geronimo Pond	30-May	Male	R9 - L8	309.1	241.8	204	203.3	-
Heath Brook Wetland	18-Jun	-	R2,3,8	170.8	142.0	121.6	110.8	-

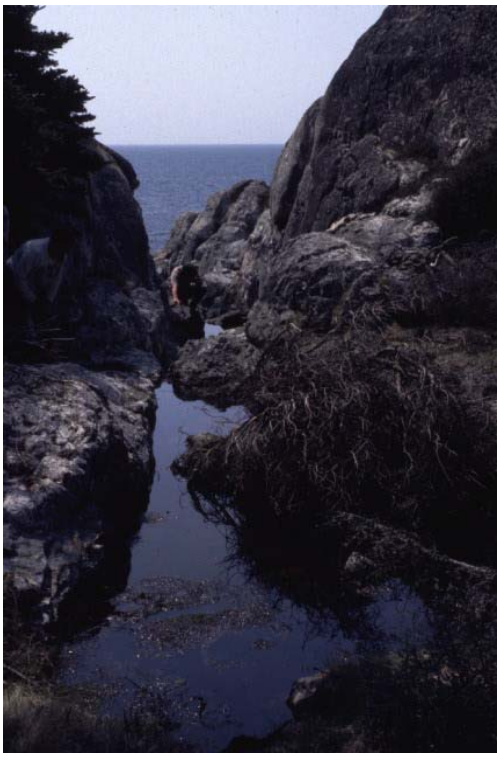
Appendix 11 All Snapping Turtles captured in Acadia National Park,25 April to 20 June 2001 (continued).

Site	Date	Sex	Notch Code	Carapace Length (mm)	Carapace Width (mm)	Plastron Length (mm)	Plastron Width (mm)	Weight (g)
Little Turtle Pond	30-May	Female	R2,8	117.8	94.9	81.5	76.6	325
Little Turtle Pond	07-May	Female	R3	280.8	237.2	199.7	185.1	-
Long Pond - MDI	27-Jun	Male	L12	310+/-1	276.8+/-1	229.4+/-1	216.1+/-1	8100
Long Pond - MDI	19-Jun	Male	R11 - L10	320.0	250.2	228.2	193.8	7100
Lower Precipice Beaver Pond	27-Apr	Male	R1,2	260.5	226.4	196.3	188.5	-
North Breakneck Pond	07-Jun	Male	-	275.3	234.8	175.5	204.7	4300
North Breakneck Pond	15-Jun	-	-	30	28	21	22.5	-
North Breakneck Pond	07-Jun	-	R1,3,8	155.8	122.9	112.7	98.4	670
North Breakneck Pond	18-May	Male	R2,3	141.8	116.2	102.8	92.2	579
North Breakneck Pond	08-May	Female	R2,4	225.2	190.3	174.4	186.9	-
North Breakneck Pond	07-Jun	Male	R9,10 - L8	370.6	304.3	265.6	228.5	-
Northeast Creek	20-Jun	-	-	32.8	31.2	22.3	22.5	11
Northeast Creek	08-Jun	Female	L10	288.0	247 +/-1	214.8	187.9	-
Northeast Creek	30-May	Male	L8,9	284.1	228.7	214.5	185.6	5700
Northeast Creek	29-May	Male	R10	235.5	179.4	164.8	146.4	3000
Northeast Creek	14-Jun	Female	R12 - L10	256.4	198.8	181.9	161.6	3800
Northeast Creek	24-May	Male	R8,10	269.8	220.7	203.6	190.4	-
Northeast Creek	30-May	Male	R8,11	364	276.3	246.7	220.9	9700
Northeast Creek	13-Jun	Male	R8,11 - L8	275.6	230.7	205	175.5	4600
Northeast Creek	23-May	Male	R8,9	293.0	258.8	216.1	202.7	-
Northeast Creek	29-May	Female	R9	314.3	257.1	234.0	201.0	7500
Northeast Creek	08-Jun	Female	R9 - L10	250.7	202.0 +/-1	184.0	168.3 +/-1	-
Route 102-west side	21-May	Female	R1,4	96.0	75.6	70.5	61.8	-
Upper Hadlock Pond	04-May	Male	R4	194.2	165.3	143.7	148.4	1720

Appendix 12. Photos of coastal breeding ponds on Eastern Head, Isle au Haut, Maine.







Photos taken by David K. Brotherton

Appendix 13. Photos of Amphibians and Reptiles in Acadia National Park.

Spotted Salamander (Duck Brook Road)

Four-Toed Salamander w/ nest (Fawn Pond)

Red-Spotted Newt (adult) (Schooner Head Wetland)

Red-Spotted Newt (eft) (Hadlock Stream)

Eastern Red-Backed Salamander w/ nest & juvenile
(Seal Cove Road Woods)

Northern Two-lined Salamander
(Richardson's Brook)

Photos taken by David K. Brotherton

American Bullfrog (North BreakneckPond)

Spring Peeper on snow (Duck Brook Road)

Pickerel Frog (Little Turtle Pond)

American Toad (Western Trail)

Northern Green Frog (Delaware Water Gap NRA)

Wood Frog (Delaware Water Gap NRA)

Photos taken by David K. Brotherton

Painted Turtle (Little Turtle Pond)

Snapping Turtle (Fawn Pond)

Northern Ring-necked Snake (Fawn Pond)

Smooth Greensnake (Sunken Heath Road)

Eastern Milksnake (Seal Cove Road Field)

Common Gartersnake (Isle au Haut)

Northern Red-bellied Snake (Isle au Haut)

Northern Red-bellied Snake (blue/gray color)
(Western Mt. Road Wetland)

Photos taken by David K. Brotherton

As the nation's primary conservation agency, the Department of the Interior has responsibility for most of our nationally owned public land and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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National Park Service
U.S. Department of the Interior

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Inventory & Monitoring Program
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